THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE SETTLEMENT OF TRADE DISPUTES.

AT a time of piping industrial peace when both trade unions and employers appear to be content to live in harmony, the Government has thought it wise to consider what steps may be usefully taken to prevent the outbreak of war in the future. The longer a truce of this kind endures, the more bitter is war likely to be when it does, in fact, break out. When the crest of the wave of prosperity has fallen, and it becomes necessary for employers to retrench, we may expect the strike to become the order of the day—and the disputes which may then occur will be all the longer and all the more strenuously fought, if the war-chests have been filled to repletion.

With a view to seeing whether there is anything to be gained by tearing a leaf out of the Canadian book, the Government recently sent Sir George Askwith to the Dominion, in order that he might inquire into the working of the Lemieux Act (The Industrial Disputes Investigation Act of Canada, 1907.)

The simple purpose of the Act is to ensure the recognition of the interests of the public, as a third party, in trade disputes, and the insistence that that third party, through the Government, shall have a voice in regard to a dispute affecting its interests, and, according to the Act, before a stoppage of work takes place. In practice the recognition extends to cases arising before or after a stoppage of work. The actual interference with the parties in the settlement of their differences is sought to be reduced to a minimum by the Act being confined to industries whose uninterrupted continuance is of high importance to the well-being of the nation (mining, railways, shipping and other public utilities); and to a brief suspension of the right to stop, as distinct from a complete prohibition of stoppage.

The Act requires that any dispute arising in connection with the class of industries named shall be submitted to a board of conciliation and investigation, with a view to arriving at a settlement before a strike or lock-out can be legally brought about. It also stipulates that at least 30 days' notice of an intended change affecting conditions of employment with respect to wages or hours shall be given, and that pending the proceedings before the Board, in the event of such intended change resulting in a dispute, the relations to each other of the parties to the dispute shall remain unchanged, and neither party shall do anything in the nature of a lock-out or a strike.

It will be seen that this is not a measure for compulsory arbitration; it only endeavours to postpone a stoppage of work in certain industries for a brief period and for a specific purpose. It does not prohibit a strike or lock-out if it is found that no recommendation can be devised which is acceptable to both sides. Since the Act was passed 132 disputes have been referred for adjustment, and in only 15 of them were strikes not averted or ended..

The Act, it appears, was originally very much opposed by the Western coal miners and railway men. It is still

opposed by the miners and their Unions, but the railway men now approve of it. The employers in Canada also seem to approve of it. Indeed, the figures above mentioned are the best possible evidence that the Act has caught on in the Dominion.

Having examined a number of persons in Quebec, Vancouver, Ottawa, and Montreal, as to the working of the Act, Sir G. Askwith is of opinion that it might be applied in some form or other in this country. In his report, which has been published as a Parliamentary paper, he writes :—

> I consider that the forwarding of the spirit and intent of conciliation is the more valuable portion of the Canadian Act, and that an Act on these lines, even if the restrictive features which aim at delaying stoppage until after inquiry were omitted, would be suitable and practicable in this country. Such an Act need not necessarily be applied in all cases, but neither need it be confined to services of public utility. It could be generally available in cases where the public were likely to be seriously affected. Without the restrictive features, it would give the right not only to conciliate but fully to investigate the matters in dispute, with similar powers in regard to witnesses, production of documents and inspection, as are vested in a Court of record in civil cases, with a view, if conciliation fails, to recommendations being made as to what are believed to be fair terms. Such an Act, while not ensuring complete absence of strikes and lock-outs, would be valuable, in my opinion, alike to the country and to employers and employed.

While we frankly admit that there are few men better qualified to form an opinion on these questions than Sir George Askwith, we are of opinion that with him the wish is father to the thought. The stubborn attitude of the English Trade Union, which brooks no interference with the alleged right of the worker to throw down his tools as and when he chooses, appears to militate against the prospects of successful legislative interference.

It is difficult to express much more than a pious hope that the Act which has proved serviceable in Canada would be of any use in this country. No foundations for such a structure have ever been laid down in England. So far from penalising those who break their contracts, the tendency appears to be to tolerate and condone every violation of the usual obligations which exist between employers and employed, and to extend the right of free speech to every protagonist who can catch the ear of the mob. Here is an extract from Mr. Keir Hardie, speaking at South Shields on December 22nd, 1912 :—"The Parliamentary Committee of the Trade Union Congress was considering proposals. . . . One proposal was that on a given date every organised worker in every trade should stop working when the eight hours were up. *No strike. . . . Simply at the end of the eight hours down tools. If that came to a lock-out, well and good.* It is an important non-resistive proposal which the employer classes would find it very difficult to resist." Our Canadian brethren have apparently examined the down-tool policy, and have found it wanting. The tree of Conciliation has been planted, and is found to flourish, in the virgin soil of our great Dominion ; but so long as the Keir Hardie type of man is at large to advocate the policy of the sudden strike and to stir up strife between employers and employed, legislation to enforce industrial peace will continue to be futile.

Ever since the year 1875 the trend of all legislation which affects trade unions has been in one direction : complete emancipation of the unions from every kind of legislative and ministerial control. They have already secured a partial reversal of the Osborne judgment. Is it likely that the demagogue, who makes his living by fomenting strife between employer and employed, will consent to any new legislation which will tend to prevent those disputes which are the be-all and the end-all of his existence ?

TRAMWAY LABOUR CONDITIONS IN AUSTRALIA.

The end of last year saw what was practically the close of the greatest labour fight in which electric tramway employés have been engaged. Although a strike formed one of the side issues in the early stages, the main interest centred in a trial in the Australian Commonwealth Arbitration Court lasting 93 days, in which no lawyers took part. The battle was for improved conditions of service, and although the men have not obtained, by any means, all that they desired or asked, they have been awarded terms which for any undertaking in this country would have been deemed fatal to commercial stability. In one respect the case promises to be historic. It is, we believe, the first time that a duly authorised court has embodied the principle of preference to Unionists in a legal award.

The case has been argued with great ability by the representatives of both employers and employés, though what the fight has cost in the withdrawal of managerial supervision on one side, and the preparation and prosecution of their case on the other, the balance-sheets of the respective organisations alone can show. The principal features of the fight have been from time to time summarised in our columns. The passing of the Australian Arbitration Act was followed by the establishment of a Men's Union having branches in all the different States. Members of this Union claimed the right to wear their membership badges while on duty. This caused trouble at Brisbane, where the right was disputed by the Tramway Co., and led to a strike which eventually spread to all trades, and a sort of general deadlock prevailed for a time. Matters settled down, and the company resumed work, employing non-unionists. A lawsuit was commenced against the company, and it was eventually decided that the men were within their legal rights in wearing their Union badge. As at the time when the decision was given the company had none of the members of the Men's Union in their employ, it was a rather fruitless victory.

Meantime the Union formulated a long list of demands, not merely covering increased wages, but practically claiming control of the manner in which the undertakings should be worked, and presented this list simultaneously to the 11 principal undertakings in the Commonwealth. Sydney being under Government control was not concerned in the dispute. Naturally the claims were refused. On the ground of there being a dispute extending beyond the bounds of a single State, the case came before the Federal Arbitration Court at Melbourne, Mr. Justice Higgins presiding. Lawyers do not appear in this Court, the cases being presented by the parties concerned. For 93 days, extending from March 4th to December 21st, the case went on, and the results are now to hand. In nine cases the parties finally arrived at arrangements outside the Court, which have since been embodied in binding agreements. If these have not been completed, awards on the basis of the principal agreement have by this time come into operation.

In the case of the remaining two undertakings—Adelaide and Brisbane—no agreements could be arrived at, and awards have been made by the Judge, which, under the Act, are binding on the parties. It should be said that the jurisdiction of the Court to decide this dispute has been questioned, and may yet be the subject of further proceedings. The men asked for a wage of 11s. per day of eight hours for all drivers and conductors, with percentage increases of 10 per cent. and 15 per cent. for various States. They have been awarded 8s. 6d. per day for the first year of service, 9s. for the second year, and 9s. 6d. for subsequent years. They asked that only 10 per cent. of the total number of drivers and conductors should be employed on broken shifts ; the award has fixed the percentage at 20 per cent., or such proportion as may be decided by a Board of Reference, consisting of representatives of both sides. The men asked for 21 days' holiday per year on full pay ; they are awarded 14 days on 12 days' pay. The men demanded preference for members of their organisation in all undertakings ; it has only been granted in one case, namely, at Brisbane. These terms vary in the case of the agreements, but are common to the awards, which in themselves differ in other minor points.

It would be interesting to know what would be the effect on the financial position of prominent British undertakings, if the awards were operative in this country. At Adelaide the tramways belong to a trust, composed of the local municipal authorities, and by law a certain sum has to be set aside annually for sinking fund. The fares are at present so high that increases are inadmissible. The present deficiency is about £15,000 per annum, and the new con-

ditions impose about a further £11,000, or additional rates in the various townships of from 2d. to 4½d. in the £.

The terms of the awards seem to us to be so severe that to a large extent they defeat their object, and, inasmuch as they interfere with the proper function of the manager, to be positively mischievous.

As regards the insertion of legal preference for the members of the Union, we cannot too strongly condemn the principle. It seems to us to introduce a new weapon of oppression into our industrial life. It is true that the Judge tried in the phrasing of the award to limit its objectionable features, and it is also true that every opportunity was given the company to avoid its insertion by agreeing not to discriminate against the Men's Union, but these facts do not, in our opinion, justify its adoption. We do not think it will bridge the gulf which in the last few years has appeared between the company and its workers, and we feel that it sets a precedent which will increase rather than lessen the friction which so often exists between employer and employé, and which it is the duty of the State to minimise by holding the scales of justice evenly between the parties. We hope, in the interests of the peaceful industrial development of the Commonwealth, that our fears may prove groundless.

Standardisation of Electrical Apparatus.

We are fully aware of the danger of standardisation in any growing industry, owing to its tendency to prevent the adoption of improvements, but the electrical industry cannot be referred to, even by its bitterest enemy, as being still in its infancy.

A number of things in the electrical world have been standardised with great benefit to all concerned, but there is, in our opinion, need for further standardisation, especially in connection with domestic appliances. Electricity has invaded the home, and is doing far more than gas could ever do to minister to our comforts.

The manufacturer, contractor, supply authority, and the consumer, are all affected by the present lack of uniformity which exists in almost all electrical apparatus. The cause is to be found in the immense improvements that have been made in design. The manufacturers have no definite rules to go on; each one acts as he thinks best, and everyone suffers to a certain extent. The general public feel that electrical repairs are expensive, for a complete new apparatus has generally to be bought, instead of its being easily possible to replace the actual part broken. It is because one maker's fuse-clip or plug will not fit another maker's fuseboard or socket that so many electricity consumers allow their installations to get into a deplorable condition before going to the expense of completely new apparatus.

A short article elsewhere in this issue points out some typical cases of electrical apparatus that could with advantage be dealt with by the British Engineering Standards Committee and the Manufacturers' Association.

Electric lighting has benefited largely, for example, by the fixing of definite standards for lampholders, and we regret that it has not been possible in the case of electric lighting and power to fix the pressure of supply and the periodicity at one or two figures that would meet all conditions.

The Association of Electrical Station Engineers.

One of the most useful and important functions of a newspaper, whether technical or otherwise, is to facilitate the free and open discussion of all subjects which lie within its scope, and thus to enable its readers publicly to commune with one another with a view to the common welfare. By no other means is it possible to open up communications between persons who do not know one another, and are often not even aware of each other's existence, but who nevertheless possess interests in common and desire to find their fellows.

It has, therefore, been a source of pleasure to us that with the aid of our "Correspondence" columns, as the result of a discussion arising out of a letter on an allied subject from a chief engineer, and extending over some three months—a discussion often somewhat irrelevant and sometimes bitter, but always turning on the grievances of the junior staffs of electricity works—the members of those staffs have been brought into touch with one another, and a new Association has been formed to voice their views and to safeguard their interests. An excellent start has been made. Within a few weeks of the first announcement of an address to write to, which appeared only in our columns, some 4,000 replies were received by Mr. Ebben, the enthusiastic and energetic hon. secretary, and a large number have already intimated their intention of joining the Association. The main objects of the latter are to raise the status of the staffs of electricity works and to improve their wages and prospects. The Association is in no sense hostile to the chief engineers, some of whom, we believe, have already signified their approval of its aims and have promised their support, and we trust that, under wise and discreet management, it will soon establish itself on a sound basis and become a prosperous and beneficent institution.

This is now the third Association which has originated directly from correspondence in our pages, its elder brothers being the Electrical Contractors' Association and the Association of Mining Electrical Engineers, both of which have amply justified their existence and have done work which could have been accomplished by no other agency; and we look to the new Association to follow in their footsteps.

Limited Parnerships.

Not much advantage appears to have been taken of the Limited Partnership Act since it was passed in 1907, as, during the five years of its existence, only some 491 firms have been registered, limiting the liability on £1,335,597 of capital. Its suitability to small trading businesses or concerns indicates, perhaps, its principal advantage, and the slow progress of the Act is no doubt due, to some extent, to certain imperfections therein and to the facilities for the registration of private companies. As is well known, every partner is liable jointly with the other partners, and in Scotland, severally also for all debts and obligations of the firm incurred whilst he is a partner, and in England he is also severally liable in certain events. The Act of 1907, which was framed upon the Continental law, confers the benefit of limiting the liability of a limited partner in a business to the contribution which he makes to the partnership in either money or property, just as the liability of a shareholder in a limited company is limited to the amount payable on his shares. Such a partner is thus enabled to participate in the profits of a business without being liable (beyond the extent specified) as a partner.

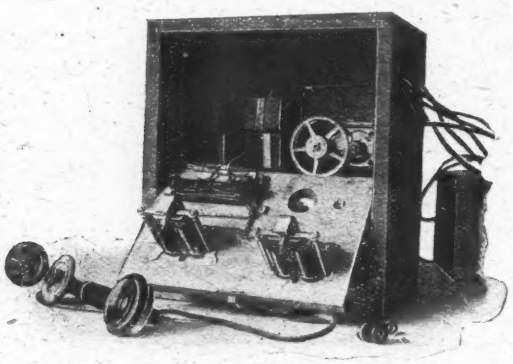
April 16th—The Benevolent Dinner.—The annual festival dinner of the Electrical Trades Benevolent Institution will be held at the Trocadero Restaurant on Wednesday, April 16th. Mr. George Sutton, of W. T. Henley's Telegraph Works Co., Ltd., will preside, and it is hoped that there will be a very large gathering of those interested in the welfare of the electrical trade benevolence movement. We trust that our readers will keep the date free, and in these "better times," of which we hear so much, will prepare to ensure a record "collection."

The National Insurance Act.—The Bradford Chamber of Trade has occasioned considerable stir among shop assistants by issuing to all the retailers' associations of the city copies of a form of agreement, by which the assistants signing it expressly relieve their employers of any legal liability for payment of wages during "absence due to sickness or any other cause." The position taken up by the Chamber is that it has been advised that, in the absence of such an agreement, employers are legally liable to pay full wages during absence due to sickness, notwithstanding the provision made for employed persons by the National Health Insurance Act and the Workmen's Compensation Act—until they have formally terminated the engagement by giving the customary notice, and that it would be a most unpleasant thing to have to give notice to a sick or disabled person. The shop assistants, however, object to the agreement in question, and, upon advice from the headquarters of the National Shop Assistants' Union, are resisting it.

BRITISH ANTARCTIC EXPEDITION TELEPHONES.

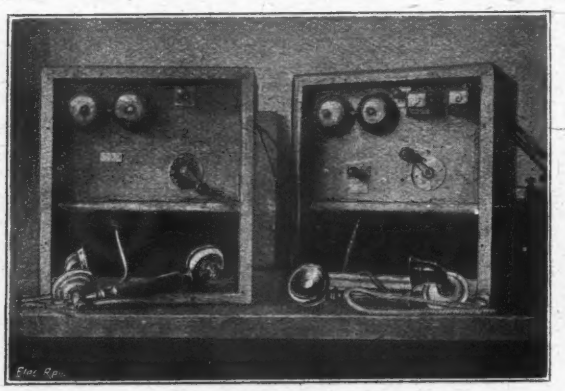
The following brief description and photographs of the telephone equipment taken to the Antarctic by Capt. Scott's Expedition will be of interest to our readers.

The installation was supplied by the National Telephone



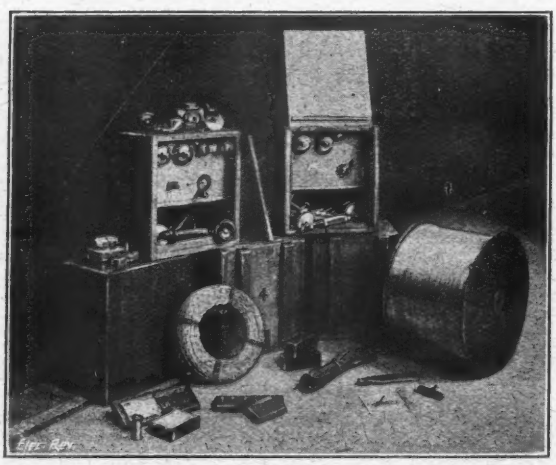
Instrument No. 1, Showing Interior.

Co., in order to enable communication to be maintained etween the winter living quarters and the outside



Instruments Nos. 1 and 2.

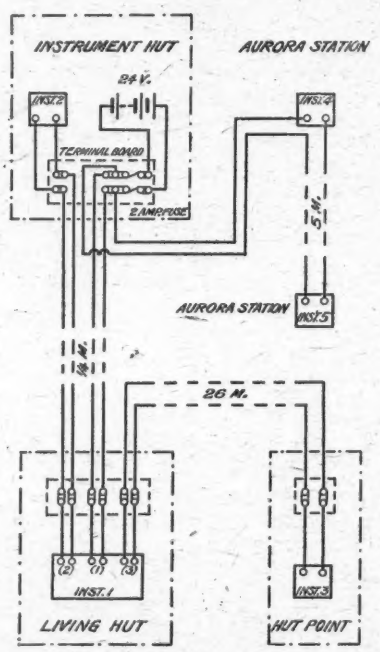
stations of the expedition. Five stations were provided for—the Living Hut, Instrument Hut, Hut Point, and two



Telephone Apparatus, Spares, and One Drum of Aluminium Wire.

Aurora Stations—and the instruments for these stations were numbered respectively from 1 to 5. The Aurora Stations were to be set up for observations of the Aurora Australis, and for this reason were required only to intercommunicate, while the living quarters were required to communicate with both Hut Point and the Instrument Hut.

On account of the extremely low temperatures to which the instruments would be exposed, it was impracticable to use any form of dry cell for local batteries, and after several experiments it was decided to make use of a 24-volt battery, forming part of the scientific equipment of the expedition, as a common battery for the different speaking circuits, in which the receivers and transmitters were in series in the line. This arrangement had the advantage of great simplicity, and with Ericsson hand-microtelephones was found to



Connections between Stations.

give good transmission. The ringing was by magneto-generators. Each instrument was self-contained in a stout wooden case, to obviate the necessity of packing for transport.

The line wire was of bare hard-drawn aluminium, No. 19 S.W.G., supplied by the British Aluminium Co. The question of weight was of great importance, and as the conductivity and strength of the wire would be improved by the temperature conditions of the polar regions, this material was selected. The total length of wire carried was about 75 miles, wound upon six iron drums, suitable for mounting on sledges, from which it would be laid direct on the ground. The go and return wires were specified to be not less than 6 ft. apart, and it was considered that the clean, dry snow would be an excellent insulator, even on the longest lines For jointing the wire aluminium McIntyre sleeves were provided.

NOTES FROM CANADA.

[From our special correspondent.]

Among the news items from Western Canada are the following :—

In Saskatchewan the town of Prince Albert will probably spend about £40,000 on a new electricity works of an up-to-date character; the purchase of two 300-h.p. boilers has already been authorised as an extension to the existing plant.

It is likely that the Government of the aforementioned province will set aside a considerable sum of money for the purpose of carrying out further research work on the subject of the utilisation of the lignite deposits for power purposes.

The town of Saskatoon is considering the establishment of a municipal electricity works.

At Brandon, in Manitoba, the civic power committee is considering the erection of an electricity works, presumably water-driven, at some few miles outside the city.

In an article on the "Engineering Outlook for 1913," the *Canadian Engineer* gives, among other things, information substantially as follows :—

The London and Port Stanley Railway, which is owned by the City of London, Ontario, will probably be electrified at a cost of $900,000.

The town of Souris, Manitoba, anticipates installing an electric-light plant, at an estimated cost of $40,000.

Two new units are to be erected at the Winnipeg hydro-electric plant at Point du Bois, and a new transmission line is to be built thence to the city. The total cost will be about $1,000,000.

Extensions to the tramway system in Lethbridge, Alberta, are contemplated; the cost is estimated at $15,000. At Medicine Hat, Alberta, it is proposed to spend $75,000 on extension of the electric lighting and power plant.

During January, Owen Sound, North Bay, Beaverton, Clinton, Elmira, Goderich, Peterboro, Stayner and Winchester all voted in favour of obtaining power from the Hydro-Electric Power Commission of Ontario, and collectively authorised the spending of $347,000 for the purpose of erecting sub-stations and constructing their own overhead distributing systems for street and house lighting and power supply.

This Commission is now calling for tenders for materials required for 125 miles of 110,000-volt transmission line and the sub-station plant required for transforming 20,000 H.P. from this voltage down to 13,200 volts.

Particulars of the former may be obtained, the writer understands, from the Board of Trade Offices in London.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electrical Engineers in India.

I read with much interest the letters which appeared in recent issues of your valuable paper. May they be a warning to those who apply for positions in India and the Far East.

Your correspondents, like myself, must have been "had." It can hardly be expressed in milder terms, as I signed a contract and came out here on Rs. 250 per month (£16 13s. 4d.) plus free quarters.

At home one often hears of cheap living in India, but I can assure you that even a bachelor on the above salary cannot associate with the European population and keep out of debt. Those who emigrate are generally men whose ambition cannot find enough scope in the Old Country, and these are the men who sign the contracts placed before them, little knowing their poverty-stricken fate. A little advice like that given in recent issues of your paper cannot but be appreciated, and should act as a warning.

No engineer should ever come to India under £30 per month.

Another Engineer in India.

Arc Lamps for the Outside Lighting of Shops, &c.

I must say Mr. Fennell's article on flame arc lighting from low-voltage mains has given many engineers food for thought; this system I consider a good way out of the difficulty of fighting the "shops across the road," if one's Committee can be persuaded to launch out in such a non-productive scheme.

It evidently meets the object it was intended for—namely, to retain the outdoor lighting; but why should he be so generous as to supply 1,500 C.P. against his competitor's 1,000 C.P. at the same figure, when it is common knowledge that the efficiency of a mantle drops considerably? Again, his capital cost of a 25-KW. motor-generator (£150) is, I consider, far below the prices of to-day.

Perhaps it would be interesting for me to detail the system I have adopted without any capital charges. This being but a small town, under 10,000 population, and having a progressive gas company to contend with, I am supplying three shops from one series of five flame lamps, and in another case two shops using five flame lamps across 250 volts.

The shops in the first instance are: Gents' mercer, using two out, one in; grocer, one out; china shop, one out. In the second instance the two shops are owned by the same man, but are about 50 yards apart, one shop using two out and the other two out, one in. By this means I am able to get a good revenue at 5d. per unit, and I do not supply or maintain the lamps or carbons.

The lamps are of the "Excello" type, by the Union Electric Co., single pair of carbons type, taking 6 amperes each. They were not all erected at the same time; in fact, only recently I added one to make up the series of five.

It is, of course, essential to select your shops, as all do not close at the same time, or on the same day. For instance, a butcher closes his shop on a Monday instead of in the middle of the week, and tobacconists', sweet, paper, chemists', and cycle repair shops do not close for a half holiday, or are not compelled to by the Early Closing Act, therefore these shops and their like must be avoided.

I must say the system here is overhead throughout, which simplifies matters considerably.

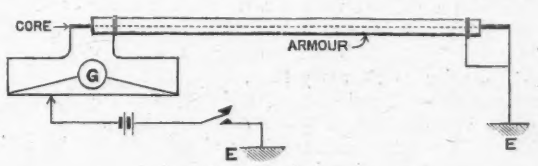
A. Preston.

Ammanford Electric Supply,
February 17th, 1913.

Testing the Continuity of Earth Conductors.

With reference to the difficulty encountered by "Continuity," I beg to suggest the following method of comparing the resistance of the earth conductor and metallic covering with the resistance of the conductor.

For example, we will take an underground three-core feeder with the armour as the earth conductor.



Disconnect at each end, and then couple one core to the armour with a well-applied bond and earth the connections at this point.

Proceed as in taking a loop test and find the ratio of the armour to the core resistance.

Instead of earthing to existing earth plates or other connections, one of the other cores can be used to represent earth during the test.

A simply constructed bridge will answer this purpose well.

Rotor.

In reply to Mr. Kivlen and others on this interesting subject, they seem only to question the continuity of cable armouring. That is not the only important point; other things, such as pumps, haulages, starters, oil switches and short-circuiting appliances in constant use and usually earthed to the armouring are a better subject for discussion, especially as regards testing Rule 14 (*c*) (i). I am not "up against it"; I have all the latest appliances for detecting and testing for leakages, and I know how to use them.

I should like to give Mr. Kivlen an instance: I have a 3,000-volt A.C. plant, and use it at 2,000 volts underground and on the surface. I have an armoured cable from the sub-station on top buried in damp soil for 300 yards before reaching the mouth of the slant; down the slant it travels for 500 yards, wet all the way, and usually covered by a few "falls" at the bottom; here you supply pumping motors, carry your earthing from the armouring to the motor frame, starter, oil switch, pump, then on to another and another pump, and more starters and switches. Every pump is dead earth in itself by reason of its suction pipes, delivery pipes, and damp surroundings; you go on with your cable to an electric haulage mounted on iron girders in damp masonry, this haulage drawing trams (iron) with steel rope on iron rails, with always 6 in. of water on the roadway, and in many places the tar cord is gone off the armouring.

D

Now, Mr. Kivlen, how would you test my earthing system for continuity, and how would you prove that my earthing system is effective, when you already have a dozen or two, what we will call, natural earths? You cannot put your pumps or pipes up on insulators to test the continuity of your own system, or get an independent test on your haulage earthing, and yet one day you may be disconnecting your pipes, &c., for some reason, and find your pump "alive," because your earth was not effective, and you could not test it, owing to having so many natural earths. If you have two pumps, both pumping from the same sump, they will be connected by pipes, water, &c., and you will get continuity without earth wires; so when you put on earth wires, how are you going to test them? The resistance is never two hours alike.

Last week I had a pillar oil switch frame "alive," and thanks to the "earth," it knocked my switch out. But was it my earth, or as the pillar stands in a wet place, did it have its own earth? These are the plain facts an ordinary colliery electrician has to face, and an answer to these may be very beneficial to many, as we all like to comply with the Act in every detail.

H. Field.

South Wales, *February 15th*, 1913.

Association of Electrical Station Engineers.

As the formation of the above Association has created general interest amongst electrical station engineers all over the United Kingdom and abroad, an account of what has been done and future arrangements would no doubt be of interest.

At the last general meeting a provisional organising committee was appointed with Mr. Chas. F. Wade as chairman, and Mr. W. A. Jones, A.M.I.E.E., vice-chairman. This Committee has examined all applications for membership received prior to February 11th, instituted some enormous propaganda work, and has endeavoured to put the Association on a sound financial and business-like basis.

A number of very enthusiastic and energetic gentlemen in the provinces are forming branches, and have been very successful; full reports are not yet to hand, but preliminary details are very encouraging. There is still scope for those gentlemen who have plenty of spare time and surplus energy to devote them to obtaining members and forming branches in those districts where there are none at present.

According to the last published Government census of production (taken in 1907) there were about 22,000 men employed in the electric supply business in the United Kingdom. Estimating roughly that about one-third (7,333) of these would be eligible for membership of the A.E.S.E., and allowing for increase to 1912, there should be about 10,000 men available for membership.

Of these we are in touch with about 4,000; a few, however, have decided on the policy of "wait and see" how the Association shapes. Now, if all of these 4,000 men would become members, and also the majority of them would obtain only two more members each, then . . . . . but, perhaps, I am too sanguine.

As soon as a good number of branches are formed it will be arranged that each shall appoint representatives (proportional to number of members) to attend a conference to draft rules and make general arrangements, &c., agreeable to the majority; the expenses of this conference will be paid from the central fund of the A.E.S.E.

The information bureau is to be an important section of the "Association," the business of which will be to compile and give information to members with regard to situations and conditions prevailing in the various districts; also it is hoped to assist employers who wish to obtain *qualified men*, provided, of course, that they are prepared to pay a salary compatible with the qualifications necessary for and the responsibility of the position. This section has aroused great interest, especially amongst British electrical engineers abroad, and a good number of these men have expressed a wish to become members of the Association.

Some question has been raised as to the attitude of employers, &c., to the A.E.S.E., but a perusal of the electrical Press of the last few months will show that they (the employers, &c.) have been advocating co-operation and combination at every possible opportunity. The result has been conferences, &c., between the British Electrical and Allied Manufacturers' Association, Municipal Electrical Association, Institution of Electrical Engineers, and the Electrical Contractors' Association. The object of all these associations is the betterment of the condition of the electrical industry, and it seems that they are agreed that it can only be done by co-operation between manufacturers, contractors, and electric supply engineers, &c.

This is a good example to those of us who have not yet become chief engineers, and imitation is the sincerest form of flattery.

Considering that active steps to form the A.E.S.E. were only taken during the Christmas week of 1912, the results (about 4,000 inquiries to date) are astounding; but, like Oliver Twist, I ask for more, and hope the other 8,000 gentlemen who have not yet taken an active interest in the A.E.S.E. will do so at once, and thus we shall be able to better the conditions of that section of the electrical profession for which the A.E.S.E. has been formed.

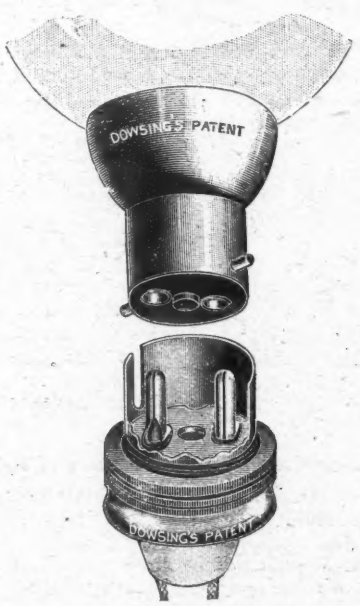
W. J. Ebben,

Hon. Sec., Association of Electrical Station Engineers.

7, Vernon Road, London, E.,
February 17th, 1913.

Screw Caps for Radiator Lamps.

Referring to the letter in your issue of February 14th signed "Jobber," with reference to the standardisation of lampholders for radiator lamps, I note he suggests that the B.E.A.M.A. should take the matter in hand. We, as the originators of the lamp radiators, very early discovered the very inefficient contact of the ordinary spring lampholders, and, in 1901, we patented an improved form of lampholder (illustrated herewith), using split pins which enter into sockets fitted in the stem of the lamp, thus ensuring a very much increased area of contact. We



have sold many thousands of these holders, which have proved absolutely satisfactory in every way, and we never get a failure.

In our opinion, the reason why these holders have not been universally adopted, is that the lamp requires a special cap to fit in the holder. The illustration we enclose will fully explain the principle, which, however, must be well known to large numbers of your readers, who, no doubt, use this lamp and holder.

We should be pleased to send a sample holder to any station engineer or to others who may wish to inspect same.

The Dowsing Radiant Heat Co., Ltd.,
H. J. Dowsing, *Managing Director.*

London, W., *February 18th*, 1913.

Heavy Service Lampholders and Adapters.

Having made exhaustive tests on the average lampholders and adapters now on the market, I have come to the conclusion that special holders should be made suitable for use where a temporary connection is needed for a small radiator, cooking utensil, or other form of apparatus taking more current than an ordinary lamp. Some firms are guaranteeing that the ordinary holder will do this, but tests made with them show that the springs of the contacts quickly deteriorate when a current of 2 amperes is passed through them. To be really useful they should carry from four to five amperes without unduly heating. If any manufacturer could meet this long-felt want, some thousands of holders could readily be sold in the city to which I belong.

Sales Superintendent.

Cost of Running Small Generating Station.

Referring to Mr. Gray's query, the cost of running the small Diesel electricity works, where the supply has to be maintained continuously, and where the output does not exceed 315,750 units per annum, with a maximum load of 160 KW., works out at ·709 of a penny per unit.

The information, however, given by your correspondent is too meagre to get a reliable figure, as the cost so much depends upon the load factor.

The figure given above is taken from the last return of the Chichester Electric Light and Power Co., who operate the small works for the supply of power and light to the City of Chichester, which works we designed and of which we are the retained consulting engineers.

Horace Boot & Partners,
Consulting Engineers.

London, S.W., *February 17th*, 1913.

ELECTROCHEMISTRY IN 1912.

In the use of the electric furnace for steel refining the United States Steel Corporation has taken a leading part, especially with respect to large-tonnage products, such as rails. The long list of breakages of rails, resulting in disastrous railway accidents, has become a very serious matter, and credit is due to the United States Steel Corporation for having undertaken to determine what can be done with the electric furnace to relieve the situation. From Mr. W. R. Walker's authoritative statement, made for the corporation in the paper before the American Iron and Steel Institute, the following sentences are significant:—"At the present time (May, 1912) there are approximately 5,600 tons of standard electric steel rails in service in the United States. These rails have been in the track about two years. During the past winter some of these rails have been subjected to very low temperature—in some cases as low as 52° F. below zero—and are being exposed to all the possible conditions of severe service . . . . Up to the present time we have not heard of any basic electric rails in use in this country being broken in service." It will be remembered that the steel for these rails is basic Bessemer converter metal transferred while in the molten state to the electric furnace for refining. Mr. Walker's statement augurs well for the future of the electric steel rail. But it is evident that before transportation companies will be willing to pay somewhat higher prices for electric steel rails for general use the experience of more years must be available. Although the commercial development will be necessarily slow, the outlook is bright.

The electric furnace for refining steel for high quality products (tool steels, &c.) is proceeding quietly and very satisfactorily. Several new furnaces have been erected. The electric furnace has been introduced into foundry practice for high quality castings. A special type of electric furnace for heating bars, billets and forgings is finding particular favour at present, as a result of the recent considerable increase in the cost of crude oil, which puts oil-firing very much on the defensive.

The use of the electric shaft furnace for iron ore reduction on a large scale (in competition with the blast furnace) is still restricted to the Scandinavian countries and California, where specially favourable conditions prevail. Under ordinary conditions the blast furnace has little to fear from its electric competitor. One result obtained with the electric iron ore reduction furnace is noteworthy. By reducing the amount of carbon and running the furnace at a low temperature, a metal is produced containing 2·2 per cent or less of carbon, a very small amount of manganese and silicon, and one low in sulphur and phosphorus. Being produced directly from iron ore in the electric furnace, it is called "pig steel," as it contains fewer impurities than pig-iron, and therefore requires less refining for making finished steel. This is probably the most hopeful feature of the evolution of the electric iron ore reduction furnace.

Any progress that promises to cheapen aluminium is of particular interest to the electrical industries in view of the competition between aluminium and copper, especially for line construction. The electrolytic production of aluminium from alumina is now so far developed, that little saving may be hoped for in this step of the process. The trend of invention is, therefore, to cheapen the cost of the raw material—the alumina—and there is at present a large activity in this field. Besides several processes which are being kept carefully secret, two loom large in the limelight. The first of these is a new process of Mr. Alfred H. Cowles, for obtaining alumina, hydrochloric acid, caustic alkali, and white hydraulic cement from clay, salt, and lime. The cheapness of the starting material, clay, and the production of the various by-products, are to result in a much reduced cost for alumina. A plant for developing the process on a commercial scale has been erected at Sewaren, N.J. The second, or Serpek process, which has been in use for a longer time on an experimental scale in a plant in France, produces aluminium nitride as an intermediate product, and finally yields pure alumina and ammonium sulphate. It, therefore, represents a combination of the production of alumina with the fixation of atmospheric nitrogen. The production of the by-product, the ammonium sulphate, reduces the cost of alumina. Both processes are interesting in another respect. Mr. Cowles hopes to make his process available for the extraction of potash, and thus to found an American potash industry which should make this country independent of Germany. In the process the ammonium sulphate by-product is also a fertiliser. Both processes, therefore, also afford an indication of the marvellous present activity in fertiliser chemistry.

Among the electrochemical processes for the production of fertilisers the two largest are utilised in the production of nitrates from atmospheric nitrogen by electric discharges through air, and in the production of calcium cyanamide. Both are commercially successful. Concerning the wonderful growth of the Norwegian nitrate industry, using the Birkeland-Eyde process, it is noteworthy that in less than 10 years this industry has grown to be one of the largest in Norway, utilising that country's enormous available water-powers, which can be developed at a very low cost, while the electrical energy could not be utilised in full for other purposes under local conditions.

As to the progress of calcium cyanamide, it is interesting to note that the Niagara Falls works are to be largely increased. Finally, it may be mentioned that the synthesis of ammonia from elementary nitrogen and hydrogen gases is now an accomplished fact, as a result of the commercial development of the Haber process by the Badische company. While it is not an electrochemical process itself, it is likely that the hydrogen gas needed as raw material will be made electrolytically.

Thus in the wonderful present growth of fertiliser chemistry—one of the greatest developments undertaken by science for the welfare of mankind—electrochemistry is taking properly a prominent part.—E. F. Roeber, in the *Electrical World*.

LEGAL.

Josephson *v.* Metropolitan Electric Supply Co.

Mr. Justice Joyce in the Chancery Division last week heard a motion by the defendants in this action, asking that it might be dismissed as disclosing no cause of action, that it was frivolous and vexatious, and an abuse of the process of the Court.

Mr. Wilbraham, in support of the motion, said the plaintiffs, Joseph Josephson and the Cosy Cinema, Ltd., claimed specific performance of an agreement to sell to them the defendants' lease of land in Amberley Road, Harrow Road, for £150. They relied upon letters passing between the parties between November, 1911, and June, 1912, but he (counsel) submitted that those letters disclosed no concluded agreement, and he further argued that the contract, if any, depended upon the plaintiffs securing the freehold, which they had not done.

The defendants were not represented, and his Lordship, holding that there was no contract, dismissed the action with costs.

Western Electric Co., Ltd., *v.* Great Eastern Railway Co.

In the City of London Court on February 13th, before Judge Lumley Smith, K.C., plaintiffs sued defendants for £35 damages for breach of duty in regard to the carriage of 10 cases of telephone accessories from Antwerp to North Woolwich.

Mr. Balloch, for the plaintiffs, said that the case was of much importance to all senders of goods by railway. The defendant company carried telephone accessories for the plaintiffs at 20s. per ton from Harwich to North Woolwich, and they became damaged by fresh water on the journey and were spoilt. The goods were carried under an owner's risk note; but the plaintiffs' case was that that exemption of the defendant company was unreasonable.

Mr. Bruce Thomas, defendants' counsel, argued that the defendants were not liable for the damage which had occurred.

Judge Lumley Smith, K.C., in a considered judgment, said the damage had occurred through neglect on the part of the defendants' servants, and not through wilful misconduct. The goods were

carried at a reduced rate at owner's risk under conditions exempting defendants from liability for damage arising from negligence (other than wilful misconduct) of their servants. The contention for the plaintiffs was that the contract was not just and reasonable within the Railway Canal Traffic Act, 1854, Sec. 7. *Primâ facie*, a contract containing exemption from liability for negligence was not just and reasonable. The burden of proving that it was just and reasonable was on the defendants, and the fact that the plaintiffs had for a long time taken advantage of the contract was in favour of its being so, but the Courts had adopted the crucial test of whether the plaintiffs had an option to send their goods at a reasonable rate with liability of the company as common carriers. In his judgment, plaintiffs did not have an alternative option of sending the goods on the terms of the defendants having the ordinary liability of common carriers. The result was that, in his opinion, the defendants had not shown that the special contract which they relied on was just and reasonable. He thought the contract must be treated as for the whole journey, and not as divisible into separate contracts for land and sea carriage.

Judgment for the plaintiffs, with costs.

British Economical Lamp Co., Ltd., *v.* Empire, Mile End, Ltd., and A. Bernstein.

Before a Divisional Court of the King's Bench Division, composed of Justices Lawrence and Lush, on February 14th, this case came before their Lordships on the appeal of the plaintiffs from the judgment of the Recorder in the Mayor's Court on December 19th.

Mr. George Wallace, K.C., who appeared for the appellant company, said that the appeal was against a decision of Sir Forrest Fulton, K.C., at the Mayor's Court, in a case tried with some despatch without a jury, and the question was raised in the appeal whether the movable bulb lamps used for electric light are part of the house. The Recorder had held that they were fixtures, and had given judgment against the plaintiff company. The action was brought by the British Economical Lamp Co. for the return of certain lamps that they had supplied to the Yiddish Theatre. The plaintiffs' business was that of letting out lamps to theatres and hotels upon agreement, a weekly rental being paid, and the plaintiffs supplied to the Yiddish Theatre Co. a number of electric bulb lamps. The landlord did not receive his rent—apparently (said counsel) nobody was paid—and he took possession of the theatre. The plaintiffs heard of this, and when they went round to the theatre to get the money due for the hire of the lamps or take them away, the landlord took the attitude that he was in possession, and that these goods were affixed to the freehold. When the case was before the Recorder, the plaintiffs called only one witness, who proved the supplying of 1,100 lamps. In cross-examination he said that there were about 800 holders for the lamps, so that there must have been 300 out of the 1,100 that were left lying loose on the premises, and were not affixed at all. The Recorder had held that the plaintiffs' lamps were fixtures, and if a thing was affixed to the freehold it became part of the house, and as long as they were part of the house the landlord taking possession took possession of everything that was part of the house. His (counsel's) contention was that these things were not part of the house. Counsel read the evidence given at the trial by an inspector of the plaintiff company to the effect that the lamps were let out on agreement at £3 per week, that rent became due for the first week, and that none had ever been paid. Mr. Wallace submitted that the decision that these lamps were fixtures and part of the house could not be supported, or there must be something in the nature of a permanent annexation to make a thing part of a house at all. These things would not be so permanently affixed as a carpet. Mr. Wallace, in reply to their Lordships, said there had been no claim to distrain. The freeholder had determined the tenancy, and in the pleadings the defence was that if the lamps claimed were on the premises, they were affixed to and became part of the premises, and were now the property of the defendants. Counsel proceeded to detail the agreement by which the lamps were let out, and Mr. Justice Lush said there was no doubt that as between the plaintiff company and the theatre company the plaintiffs remained owners.

Mr. Wallace said the case was one of great importance to the plaintiffs, because if they were liable to hand the lamps over to the landlord taking possession, they would often be in the predicament in which they now found themselves.

Mr. Rankin, for the other side, argued that the decision of the Recorder, on the decided cases, was correct, and that they were fixtures, and after considerable argument the Court said judgment would be reserved.

Platinum.—As is pointed out in an article in the *Chicago Mining and Engineering World* for January 25th, most of the world's platinum still comes from the Ural Mountains, a small quantity being recovered in the United States from the gold places of northern California and western Oregon. This production, from a table furnished by the United States Geological Survey, was highest in 1906 with 1,439 oz., and now amounts to 800 oz., valued at £6,960. The estimated Russian output for the past year is 310,150 oz. Columbia produced 11,750 oz., and Australia and Canada contributed small quantities, not estimated.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—X.

(*Continued from page* 194.)

The hearing of the case against the Brisbane Co. was continued, Mr. Frew continuing his address on their behalf. He submitted that no grievances had been submitted on behalf of the men's Union to constitute an inter-State dispute, and that consequently the Court had no jurisdiction. Holidays the company regarded as a luxury, not a necessity; but on this matter they had received no complaints. They did not think they should be called on to provide watches for the men. As to the wearing of the Union badge, the company could not agree to it. The company were not prepared to give the undertaking asked for by the Judge that in making future appointments they would not discriminate between Unionists and non-unionists. They had 680 members of another Union in their employ which were not in any way connected with the claimant Association, and the company did not feel it would be fair to this new Union to give the undertaking. The Judge pointed out that this decision would mean that in his award he would order preference to be given to Unionists, but the company would not alter their decision.

A day or two later, the Judge, Mr. Justice Higgins, handed to the representatives of the Brisbane and Adelaide Companies a draft of his proposed awards, and a day or two later heard objections to them both from the companies and the secretary of the men's Union. Two days afterwards, on December 21st, the Judge gave his final award.

The principal points in the Brisbane award are :—

Minimum wages to be paid to members of the men's Union—Motormen and conductors, first year 8s. 6d. per day, second year 9s., third year 9s. 6d.; signalmen 10s. (signalman includes any man who regulates tramway traffic at intersections); point boys 6s., lamp trimmers 8s. 6d., electrical mechanics (if electrical fitters) 11s., pitmen 9s. 6d., pitmen's assistants, 8s. 6d., car-washers or cleaners, 8s. 6d., overhead wiremen, first or leading, 10s. 6d., assistant 9s., horse car wagon drivers 8s., engine drivers 12s. 6d., boiler cleaners 8s. (with 6d. per hour extra when working inside boilers), greasers 9s., firemen on four fires 10s., on less than four fires 9s. 6d., trimmers or fuel men 8s. 6d., track gangers 9s. 6d., fettlers and trackmen (otherwise called maintenance men) 9s., track cleaners or sweepers 8s. 6d., horse dray drivers 8s., night watchmen 8s., lavatory men 8s., labourers not otherwise specified 8s.

A day to mean eight hours' work, overtime to be counted for first hour per day at time and a quarter, afterwards as time and a half for motor men and conductors. For other employés, week's time to be 48 hours, with time and a quarter for first two hours excess and time and a half afterwards. Between certain hours double time to be paid. For Sunday work time and a quarter to be paid, and on holidays time and a half. Holidays to be Christmas Day, Boxing Day, New Years' Day, Good Friday, Easter Monday, Eight Hours' Day, Anniversary Day and King's Birthday. All employés to have one day off per week without pay. After 12 months' service to have 14 consecutive days off with 12 days' pay, and to be given 7 days' previous notice of date of holiday. There are certain small exceptions to this rule.

The ordinary spread of hours not to exceed nine hours per day, except for 20 per cent. of the whole number, or such other proportion as may be allowed by the Board of Reference who may work in broken shifts with a spread of hours not exceeding 12 per day. Ten minutes to be allowed to motormen and conductors for signing on, and a similar period for signing off. No motorman or conductor to be on duty longer than five hours without meal relief, or to be liable to be called on to resume duty at a shorter interval than 10 hours, or to work more than six consecutive night shifts. When required to attend by roster, an employé is not to be paid for less than four hours, unless he has two hours' notice. Every motorman or conductor signing on for duty to have a full day's pay. Promotion to be governed by efficiency, and, in the event of equal efficiency, by seniority. Efficiency means special qualifications and aptitude for the discharge of the duties of the office to be filled, together with merit and good and diligent conduct. When employed on different duties, the employé to be paid the highest rate for any of his duties. Time spent in making written reports to be paid for. Time occupied at the request of the company in attending inquiries—unless for employé's own misconduct—to be paid for. The company to supply conductors with sufficient change.

In view of an appeal to the High Court on the question of the wearing of the Union badge, the award on this question was reserved. Officers of the men's Union are to be allowed to collect subscriptions and transact the business of the Union providing they do not interfere directly with the working of the tramway, or, if they are employés, fail in their own duties. A list of employés with order of seniority as to service shall be exhibited at each depôt. All cars to be fitted with seats for motormen within six months, for use by the motormen as approved by the Board of Reference. All cars within the same period to be fitted with suitable side and end guttering to carry off water. The most important section of the award related to preference, and as it was the first time in which this principle had been embodied in an award it is advisable to quote it in full :—

"As between members of the claimant organisation and other persons offering or desiring service or employment at the same time, preference shall, in the manner hereinafter specified, be given to such members, other things being equal. Before making the appointment, the company shall satisfy itself that the proposed

appointee is a member of the Association, or that there is no member of the Association applying who is equally suitable for the appointment, apart from the fact of his membership."

The rest of the award states that complaints against employés shall be given them in writing, and that the accused shall be allowed to call witnesses on his behalf, and shall, if possible, be confronted with his accuser. If the charge is not sustained, the employé shall be paid for his time, and reasonable charges allowed for his witnesses. If the men's Union disagrees with the company's finding, the matter shall be referred by either party to the decision of the Board of Reference.

Provision was made for the constitution of the Board of Reference.

The new rates of wages were to be retrospective from October 1st, and the provisions as to spread of hours, from February 28th.

In making the award, the Judge referred to the length of the case, as it had occupied the Court for 93 days, or longer than any case he had had to deal with. This, in his opinion, was partly due to the difficulties of the case, and partly to defects in the Act.

He then gave a long and detailed account of the Brisbane dispute, which had done so much to impart acrimony into the whole question. He felt that the attitude of Mr. Badger, the manager, was unjustifiable and autocratic. In the Judge's opinion, the Arbitration Act encouraged the formation of employés' unions; in Mr. Badger's opinion they were very objectionable. He felt, therefore, that he must condemn the position taken up by Mr. Badger and his company, and as they would not agree to discontinue discriminating between non-unionists and Unionists, to the disadvantage of the claimant Association, he felt it necessary to award preference for the men's Union.

He had tried, in wording this clause, to so phrase it as not to curtail the efforts of the manager to get efficiency in his service. He regretted the necessity for taking this course; it was the first time he had done so, but the action of the company had rendered it necessary.

The company had raised the question of an Act recently passed by the Parliament of Queensland, which limited his powers to grant preference to members of the men's Unions. If such a point were seriously raised he should, as a member of the High Court which would have to decide it, preserve an open mind.

The position with regard to the other awards was gone into at the same time.

(*To be continued.*)

OUR LEGAL QUERY COLUMN.

[*Questions addressed to this column should be written on one side of the paper only.*]

"INQUIRER" writes:—"It is proposed to form a small private company to supply current for private lighting in a small town. The local (parish) council have no intention to apply for powers, and would offer no objection to overhead mains, the road authority being the County Council.

"What powers are necessary in order that the company may be in a legal position to supply current, and in order that their interests may be protected at any future time in the event of opposition by any other company or body, and how could these powers be obtained most easily and cheaply? Would a licence from the B. of T. be sufficient? In what way could the local gas company offer effective resistance (if any) to the powers being obtained?"

*** If the local authority of a district are not supplying electricity, it is competent for any person or persons, whether they are a company or not, to fulfil the *rôle* of supply authority. The Electric Lighting Act of 1909 made no difference in this respect, it being there provided by Sec. 23 that where in any area a local authority, company or person is authorised to supply electricity under Act of Parliament or under licence or provisional order granted under the Electric Lighting Acts, it shall not, after the passing of this Act, be lawful for any other local authority, company or person to commence to supply or distribute electricity within the same area, unless such supply or distribution is authorised by Act of Parliament or by licence or provisional order granted in terms of the Electric Lighting Acts; provided that this section shall not prevent any company who at the passing of this Act are empowered by their memorandum of association to generate electrical energy, from affording a supply to a railway company for purposes incidental to that company's undertaking, other than the conveyance of public traffic.

As to the second half of the query, a company may get to work either under licence or provisional order. The form of that provisional order will be found in the schedule to the Electric Lighting Clauses Act, 1899. But even if they do not work under provisional order, they cannot be prevented or interfered with by the local authority in the future, nor would the opposition of the gas company be successful.

International Congress of "Cold."—The third International Congress, organised by the Association Internationale du Froid, will meet in the United States from September 14th to 24th. The Congress will open at Washington on September 15th, and the actual sittings will take place at Chicago. Particulars can be obtained from the Association, 9, Avenue Carnot, Paris.

BUSINESS NOTES.

Trade Press Exhibit at Ghent.—The trade and technical Press of this country is to play an important part in the British Section at the Ghent International Exhibition, which opens at the end of April, for a collective display is being organised by the Exhibitions Branch of the Board of Trade. A number of papers (including this journal) have already arranged to participate, and, under the scheme which has been adopted, it is expected that the display will attract much attention. The exhibit will take the form of a large reading room and library, where current numbers of the papers will be found on reading tables and bound volumes on the shelves which line the walls. A visitor will consequently be able, not only to see the latest copies of the papers which interest him, but also to refer to back volumes to see the range of subjects dealt with. The library has been specially designed by Mr. Frank Brangwyn, A.R.A., and the work is being carried out under his personal direction. It has been found possible to allot one of the best positions in the British Section to the library. On one side it opens direct on to the main avenue through the Exhibition grounds, and a large proportion of the visitors entering the British Pavilion must pass through it; on another side it communicates with the offices of the British Section. It also leads out of the gallery devoted to Arts and Crafts. This is the first occasion that such an exhibit has been made by British trade papers, and it is hoped that it will create great interest among Continental business men, who will thus have an opportunity of becoming familiar with not only our trade papers, but also their advertisements of British manufacturing firms. The Exhibition will remain open for at least six months, and during that time a great deal may be done to advance British trade interests. The Exhibitions Branch of the Board of Trade have arranged for an official of the British Chamber of Commerce in Belgium to be in charge of the library in order to answer all questions and furnish daily reports to the proprietors and editors of the papers taking part.

Exhibition in Sweden.—An international exhibition is to be held at Malmo in 1914, under the auspices of the Swedish Government. It is styled the "Baltic," and the participation of the States bordering on the Baltic have been specially invited, but other countries are not necessarily excluded. Machinery, especially electrical, will be strongly represented.—*Elektrotechnik und Maschinenbau.*

Consular Notes.—Spain.—The American Consul at Barcelona reports that there is a good and increasing demand in Spain for foreign electrical supplies such as electric motors, dynamos, &c. The use of electricity is greatly increasing in all parts of the Peninsula, not only in the principal centres of population, but also in the country where water power is chiefly used in the factories and for lighting purposes. In fact, there is a surprising number of small and relatively unimportant towns lighted by electricity. To meet this increasing demand for electrical supplies of all descriptions, Spain is obliged to purchase considerable quantities of these goods abroad, the total imports of electric apparatus in 1911 amounting to about £730,000, as against about £600,000 in 1910, and about the same in 1909. Only a small part of these imports came from the United States, and apparently very little effort has been made to introduce American electrical goods into the country. German manufacturers, on the other hand, are extensively represented in the important industrial centres, and it is as a result of this, that Germany succeeds in supplying about two-thirds of all the electrical machinery and apparatus imported. Relative cheapness also gives German products an advantage over those of other countries. In 1911 the total imports of electric motors, dynamos, regulators, and transformers, amounted to about £436,000, as against about £368,000 in 1910, and about £365,000 in 1909. No statistics are at present available showing the imports for 1911 by countries, but in 1910 Germany was the chief supplier of these goods, sending £136,000 worth of electrical machinery weighing from 880 lb. to 11,000 lb. and upward. France, England, and Switzerland were next, with £18,000, £18,000, and £28,000 respectively. The United States supplied £2,750 worth of this class of machinery. Germany also sent £103,000 worth of electrical machinery weighing 880 lb. and less, followed by France, Great Britain and Sweden with much smaller amounts. Imports from the United States in this line amounted to £2,000. There is an especially good demand for this class of machinery, which is evidenced by the fact that the imports nearly doubled in the past three years. The importation of electric accumulators and batteries is not important, amounting to only £65,000, which is almost entirely supplied by Germany, France and Great Britain, in the order named. On account of the increased home production, imports of electric cables and wires are gradually declining. Germany again holds the first place in this line, importing in 1910 £33,300 out of a total of £50,000. There are four factories for electric cables in the Province of Barcelona, and various others in different parts of the country. A steady increase is observed in the imports of telephone and telegraph apparatus and electric meters, which the Spanish tariff classifies under one heading. Imports amounted to £50,000 in 1909, £57,000 in 1910, and £68,000 in 1911 Germany is the chief supplier of these articles, furnishing in 1910 118,146 lb., valued at £33,000; but these imports consisted, for the largest part, of telegraph apparatus. Telephone apparatus is almost exclusively supplied by Sweden and France, imports from these countries amounting to £6,500 and £8,600 respectively. The

United States supplied 32,568 lb., valued at £900, but it is difficult to say just what articles are included therein. Electric meters are manufactured locally, there being two factories for this article in the city, the output of which is estimated at over 100 meters of various kinds daily. Imports of arc lamps are on the decline, the total imports amounting to £9,000 in 1911, as against £13,500 two years ago. Over two-thirds of the imports are of German manufacture. A surprising increase is noted in the imports of incandescent globes (mounted ready for use), which amounted to £81,000 in 1909, £95,500 in 1910, and £135,000 in 1911. There are now 10 factories for this article at Barcelona alone, but, notwithstanding their increased output and the constant erection of new factories, imports continue to rise. Again Germany is the principal supplier, furnishing in 1910 about £80,000 worth of incandescent globes. France and Austria-Hungary are also in the market, but with much smaller amounts. The actual wholesale price of globes manufactured in the country is 37s. 6d. per hundred, and imported globes sell at 70s. per hundred, payable at 90 days.

A new movement now on foot in the district of Catalonia to utilise water-power for the production of electricity has brought about a decrease in the price of electricity for both power and lighting purposes. Consequently many manufacturers at present using steam are considering the installation of electricity, and the demand for electrical machinery and supplies is expected to increase considerably in the near future. Barcelona and Bilbao are important receiving points for all kinds of electrical supplies, the latter port especially for electric cables.

Paraguay.—The American Consul at Asuncion reports that with the completion of the Asuncion electric light and power plant in 1913, there will arise a demand for motors and other electrical utilities, opening up a new field for manufacturers, provided they are ready to compete with the concessionaires of the plant who are connected with German sources of supply. As indicating the failure of American firms to grapple with conditions adequately the Consul states that soon after the concession was granted, he reported opportunities for certain electrical appliances for which an agency was needed in Asuncion. Replies were received from leading manufacturing concerns in the States, but led to no result, chiefly for the reason that definite estimates could not be made without much trouble from the price lists obtained. In one instance it took a fortnight to figure out an estimate for 15,000 electric lamps, fixtures, &c., on account of the variation in discounts. If there had been one discount for a whole list or a discount for a page, say, of classified articles, the American house would have stood on a more equal footing with its competitors. Some manufacturers made no offer to establish a direct agency, but offered to deal through their Buenos Ayres agents, apparently not realising that there are competitors dealing directly with this territory. Prices were often quoted f.o.b. at the factory, perhaps some interior point in the United States, leaving the prospective purchaser quite in the dark as to what he could offer the goods for here. Prices should at least be f.o.b. port of embarkation. Better still would be prices c.i.f. Monte Video or Buenos Ayres, but, best of all, c.i.f. Asuncion. Transportation companies and forwarding agents should make this possible.

Guadeloupe.—The American Consul at Guadeloupe reports that the concessions granted to Hubert Ancelin, of Basse Terre, for the electric lighting of Point à Pitre, Basse Terre and Sainte Claude, put up for sale in the middle of 1912, have been taken over by the Société Anonyme d'Electricité de la Guadeloupe, composed of local capitalists. The stock of the company has been fully subscribed and one-half paid in. It is the intention to build only the Basse Terre plant at present. This plant will have a capacity of 18,000 C.P. of incandescent lights, of which 1,500 C.P. is to be furnished for lighting the Colonial Government buildings, and 2,000 C.P. for lighting the streets and municipal buildings; the balance is for private subscribers.

For the light furnished to the Government and municipality, a subsidy of approximately £1,200 per year is guaranteed under the terms of the concessions, and, under certain conditions, additional payments may be obtained. The amount which can be charged private subscribers is fixed at $\frac{1}{20}$d. per C.P. per hour, but this is modified by a clause which permits the company to make private contracts; the use of meters for measuring the current furnished is optional. In private installations, it is provided that the current shall be brought free of charge to each building, but that the subscriber shall pay all costs within the building, all materials to be furnished by the company at the catalogue prices of French dealers in such commodities, plus 25 per cent. at the highest. Orders for the necessary equipment will be placed with the Thomson-Houston Co., Paris, and work was to begin in the early autumn. The high tariff on electrical supplies precludes orders being placed elsewhere than in France. The life of the concessions is 40 years, and at the end of that period the entire plant becomes the property of the Government and municipality.

Osrams in Shanghai.—Recent advices from the General Electric Co., of China, Ltd., shown that the Osram drawn-wire lamp is becoming very popular there. At the company's Shanghai branch, orders are frequently received for the lamps in lots of thousands. Indeed, during a fortnight in last November, orders aggregating 13,000 Osram lamps were secured from cotton mills in Shanghai alone. Furthermore, the Shanghai Tramways have ordered 1,000 Osrams.

New Map.—Mr. Edward Stanford has issued his usual map for the Parliamentary Session, 1913, showing the proposed railways, tramways and other schemes affecting London in connection with Bills where plans have been deposited with the L.C.C. The price is 2s.

Strike.—We are informed that the strike which is in progress at the works of Messrs. Evershed & Vignoles, Ltd., came about in consequence of a workman being discharged for neglecting his work. The men consider that he was harshly dealt with, and demand his reinstatement—a demand which the company, in view of all the circumstances, are not prepared to concede. We understand that the employés in the stores, packing department and winding and lacquering rooms are fully at work; further, that every member of the staff throughout the works is doing his utmost to help the company, and a considerable amount of work is thus being completed.

The N. T. Journal.—The liquidator of the National Telephone Co., Ltd., is disposing of the back numbers of our now defunct, but always excellent, contemporary, *The National Telephone Journal*. There were 70 monthly numbers, and only three are out of print, and any reader requiring a set can have same for a comparatively nominal charge by addressing, Mr. V. Baldwin, Room 37, Telephone House, E.C.

Sweden.—It is reported from Stockholm that a new subsidiary company has been formed by the A. B. Ljungström Steam-turbine for the purpose of erecting special workshops for the manufacture of the Ljungström turbine. Up to the present there has been no workshop suitable for building these engines commercially, and those turbines that have been completed have all been made for experimental purposes. The new company has a capital of £77,777, and it has already purchased suitable factory buildings in the small town of Finspong. The orders for turbines already booked are said to amount to a total capacity of 27,000 H.P., and there are in addition a number of engines that the company has been unable to deal with.

Our Swedish contemporary *Affärsvärlden* has made an inquiry of the Nya Elektriska A.B., of Stockholm, with regard to the electrical industry in 1912 and the prospects for 1913. In reply, the company states that the demand for all kinds of electrical goods has been far more lively than in 1911, and the customers have increased in number. The number of electrical power stations projected or under construction, however, has been declining somewhat, a fact which is attributed to the uncertain conditions which will prevail until the policy of the Government in regard to the future has taken shape. The prospects for 1913 are very favourable, and the year will no doubt be one of increased activity, provided only that the Balkan war does not cause any greater disturbances. A large number of extensions are going to be made in the course of 1913, and the new plants to be erected are also numerous.

Dissolutions and Liquidations.—Renard Road and Rail Transport Corporation, Ltd.—A meeting is to be held at 82, Victoria Street, London, S.W., on March 18th, to hear an account of the winding up from the liquidator, Mr. H. A. Grimsdick.

Natural Gas and Power Co., Ltd.—A meeting will be held on March 19th, at 11, Ironmonger Lane, London, E.C., to hear an account of the winding up from the liquidator, Mr. W. B. Peat.

Premier Bitumen and Asphalte Co., Stratford, London.—Messrs. H. Levin and C. R. Berry have dissolved partnership. Mr. Berry will attend to debts and continue the business under the same style.

J. Stiff & Sons, High Street, Lambeth, London, S.E.—With reference to the purchase of the goodwill and connection of this business by Messrs. Doulton & Co., Ltd., last December, the partnership of S. J. Stiff, J. A. Stiff, and W. F. Stiff, as J. Stiff & Sons, was dissolved as from December 31st, and accounts against the firm should be sent to them without delay.

Kevan Electric Co., Ltd.—Liquidator (Mr. H. de V. Brougham) released February 11th, 1913.

Book Notices.—*The Universal Electrical Directory* (J. A. Berly's). 1913. London: H. Alabaster, Gatehouse & Co. Price 21s. ("A" edition, containing "British and Colonial" sections only, 12s.).—This very useful directory of electrical men and electrical trades, has now reached its thirty-second annual issue. It contains between 1,500 and 1,600 pages of closely packed directory matter, which everybody having relations with electrical men, either at home or abroad, ought to have within easy reach. In the first section it contains alphabetically arranged names and addresses, and where possible, the telegraph addresses and telephone numbers, of all electrical men and concerns in and around London. A similar provincial section comes next, a full British Classified Trades Section following. The usual handy British Geographical Section, Colonial and General Foreign Alphabetical and Classified Sections, Continental and U.S.A. Alphabetical and Classified Sections, then appear in the order stated. The Electricity Works Sections, both for Home and for the Colonies and many foreign countries, contain invaluable information respecting chief engineer, character of current, voltage, and so on, and in the alphabetical sections for both London and the provinces, financial information regarding companies is given. Produced, as the work is, in its present form as the result of very lengthy experience, and embodying alterations which changing years and the needs of users have proved to be necessary, we anticipate that it will be required in most business houses where communicating with electrical men is a daily necessity. Knowing only too well the importance of having reliable and full information respecting Colonial and foreign addresses, in these days of growing export electrical and engineering trade, the publishers and compilers have incurred heavy expense in their endeavours to ensure completeness and accuracy in this respect. To thousands of offices this information alone should be worth many times the cost of the book.

Japanese Register of British Trades. London: Far Eastern Advertising Agency, Ltd.—This volume has been printed and produced in Japan with native labour. It has been compiled consequent upon the need for such a publication by leading manufacturers in Japan who wanted to get into direct business relationship with manufacturers in this country. We hope that the book will be the means of increasing our trade connections with the enterprising business spirits in Japan. A large number of British names and addresses are given in classified trade sections. We understand that the work of revision and addition is being taken in hand for a 1914 edition.

"*Transactions* of the Institution of Engineers and Shipbuilders in Scotland." Part IV, 1912-13. Glasgow: The Institution.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 9. December, 1912. New York: The Society. Price 75 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXII, No. 2. February, 1913. New York: The Institute. Price $1.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXX, No. 1. January 1913. Philadelphia: The Club.

"*Bulletin* Mensuel de la Societe Belge d'Electriciens." Vol. XXIX, No. 11. November, 1912. Brussels: E. Bruylant. Price 1 fr. 75 c.

"Calculs Techniques et Economiques des Lignes de Transport et de Distribution d'Energie Electrique." By C. Le Roy. 1913. Paris: Hermann et Fils. Price 6 fr.

"Bells, Indicators, Telephones, Fire and Burglar Alarms, &c." By J. B. Redfern and J. Savin. Price 1s. 6d. net. "Iron and Steel." By O. T. Hudson and Guy D. Bengough. Price 6s. net. London: Constable & Co., Ltd.

"*Transactions* of the University of Toronto Engineering Society." Vol. VII, No. 3. January, 1913. Toronto: The University.

"*Journal* of the Western Society of Engineers." Vol. XVII, No. 10. December, 1912. Chicago: The Society. Price 50 cents.

"La Théorie du Rayonnement et les Quanta." By P. Langevin and M. de Broglie. Price 15 fr. "Sur les Effets Physiologiques des Courants Electriques." By Dr. G. Weiss. Price 5 fr. Paris: Gauthier-Villars.

"Essentials of Electricity." By W. H. Timbie. 1913. London: Chapman & Hall, Ltd. Price 5s. 6d. net.

Hearty congratulations to our contemporary the *Financial Times* on the celebration of its twenty-fifth birthday. Advantage was appropriately taken of the event for the publication of a bumper issue on February 13th, in which many interesting special articles and illustrations appeared, giving a mass of information of particular interest to all who are concerned with finance and commerce.

Bankruptcy Proceedings.—WILLIAM LONGDON and VERNON GEORGE COBB (trading as Longdon & Cobb), electrical engineers, 101A, Derby Road, Nottingham.—The public examination of the above-named debtors was held at the County Court House, St. Peter's Gate, Nottingham, last week, when the liabilities were put at £291, and the assets were estimated to realise £45, leaving a deficiency of £246. In answer to the Official Receiver, the debtor, Longdon, said he had been connected with the electrical engineering trade for over 30 years, and started trading on his own account about four years ago. The work had increased considerably, and in March, 1912, needing assistance, he took Cobb into partnership, the latter introducing a capital of £150. The business had not proved a success, and creditors began to press them as soon as the partnership was entered into. The case was adjourned so that the debtors might furnish a cash and goods account for a certain period prior to the date of the receiving order.

J. W. LEWSLEY, electrician, Nottingham.—Receiving order made February 14th on debtor's petition.

HARRY THORPE, electrician and engineer, 11, Bartholomew Villas, Kentish Town Road, London, late of High Holborn and Holloway.—Adjudication annulled on February 3rd, "it appearing to the satisfaction of the Court that all the debts herein have been paid in full." Date of adjudication, April 7th, 1905.

Catalogues and Lists.—MESSRS. WALTON & CO., Newton Street, Birmingham.—Advance copy of price list, with illustrations, of leather fillets, brass dowels, iron dowel plates, birchwood dowels, steel spring washers and leather washers for pattern shop and other purposes. This forms the first section of a price list which is intended to cover the requirements of the works manager.

THE ARMORDUCT MANUFACTURING CO., LTD., of Farringdon Avenue, London, E.C., have issued a card with map showing how their premises may be quickly and conveniently reached from the principal suburbs.

MESSRS. COOKSON & CO., 25, New Oxford Street, London, W.C.—New lists of C. and C. ignition and car-lighting accumulators, traction accumulators, india-rubber corks and collars, and hydrometers for accumulators, also cheap engineer's watches.

THE DEROME STANDARD PULLEY BLOCK AND CRANE MANUFACTURING CO., 78, Southwark Street, London, E.C.—32-page booklet (No. 78) containing revised prices and illustrations of their various cranes and pulley blocks.

A.E.G., Berlin.—Nos. 1 and 2 of "Mitterlungen aus dem Kabelwerk Oberspree," dealing with insulating materials, and armoured flexible cables for portable tools.

THE PARAGON WIRE MILLS, 10-12, Norman's Buildings, St. Luke's, London, E.C.—Price leaflets of silk and cotton-covered copper wires, bell flex, bell wires and braided wires.

THE SLOAN ELECTRICAL CO., LTD., 12, Golden Lane, London, E.C.—New catalogue of 40 pages, containing illustrations and clearly tabulated prices of various types, shapes and sizes of metallic and carbon-filament lamps, namely, Auriga, Foster, Mazda Osram, Philips "UK," Tantalum, Wotan, Z, and Tubolite. Each section begins with a reprint in colour, and on a small scale, of the lamp-maker's poster. The company holds large stocks of all the lamps mentioned.

MESSRS. VERITYS, LTD., 28, King Street, Covent Garden, London, W.C.—New list (eight pages) giving illustrated particulars and prices of the "Aston" automatic lighting sets, also several types of fans (Typhoon, Delhi, Rangoon, and Ceylon).

MESSRS. JOB DAY & SONS, LTD., Ellerby Lane, Leeds.—Illustrated leaflet giving notes regarding the design and construction, &c., of their high-speed vertical engines.

Trade Announcements.—THE COUNTY ENGINEERING AND LIGHTING CO., LTD., of 10, Colonnade, New Street, Birmingham, announce that they have now given up contracting work and are taking up the business of engineers' agents. They have just been appointed sole agents to the Sun Electrical Co., for Birmingham and district.

For "*Baldwin*" Engineering and Supply Co. under this heading last week read *Baldur*.

MR. R. H. JOHNSTON has resigned his position of London manager for the Rees Roturbo Co., Ltd., of Wolverhampton, and has entered into partnership with Mr. P. B. Down, also of the same company. The firm of Down & Johnston have their offices at Craven House, Kingsway, and are carrying on business as manufacturers' agents in plant, machinery, centrifugal pumps, and steam turbines. They desire to receive catalogues from makers of other specialities.

THE MIDLAND MANUFACTURING CO., LTD., of Rea Street South, Birmingham, will, in future, operate two telephone lines with a private branch exchange, Nos. 671 and 672 Midland.

LIGHTING and POWER NOTES.

Barwell.—The P.C. has decided to submit to a meeting of parishioners a scheme of public lighting proposed by the Leicestershire and Warwickshire Electric Co., which offers to light the streets from August to April until 11.30 p.m. each day with 50-C.P. lamps at £2 10s. per lamp per season.

Belfast.—A special meeting of the Tramways and Electricity Committee has given further consideration to the question of the proposed extension of the electrical undertaking. Prolonged discussion took place on the reports of the city electrical engineer (Mr. Bloxam), and in the result the Committee passed a resolution expressing the opinion that an extension of the electrical undertaking was necessary. It instructed Mr. Bloxam to submit some further information at a special meeting to be held on 26th inst.

Bingley (Yorkshire).—The District Council has decided to enter into an agreement with the Keighley Corporation for the supply of electricity in bulk, and to apply for powers to borrow £5,500, the estimated cost of cables, sub-station and machinery; the agreement with Keighley is to be for ten years. In reply to a letter which had been received from the local Property Owners' Association, the chairman of the Council said much consideration had been given to the possibility or otherwise of Bingley generating its own supply by means of its own water power facilities, and an expert on the subject had given advice that such a scheme would not pay for several years even if there was sufficient water power, which there was not.

Cardiff.—In the electric lighting department, Mr. Arthur Ellis estimates for the year an expenditure of £52,200, as against an estimate of £45,714 for last year, and an income of £55,268 as against £50,750, thus allowing for an estimated surplus of £3,067, as against an estimated surplus of £5,035 last year, and an actual surplus of £2,458 in 1911-12.

Carlisle.—The Public Lighting Committee has decided to erect flame arc lamps in several parts of the borough, and has requested the Electricity Committee, along with the Gas Committee, to consider the question of reducing the charges for public lighting as and from the end of the present financial year.

Chatham.—An installation of electric lamps in the High Street, carried out by the Kent Electric Power Co., Ltd., was inaugurated on Monday, the current being switched on by the Mayor.

Chesterfield.—The T.C. has decided to supply current to the Chesterfield Tube Co., Ltd., at 7·5d. per KW.-hour for the first 100,000 KW.-hours per annum, this price to be reduced by ·005d. per KW.-hour for each additional 10,000 KW.-hours, until the minimum price of ·65d. is reached for a supply of 300,000 KW.-hours. The company is to pay a minimum of £500 each year.

In order to economically meet the large and increasing demand for current on the south side of the town, high-tension transforming machinery and transmission lines are to be provided, at an estimated cost of £3,040, to be met out of revenue.

Christchurch (Hants.).—At the last meeting of the B. of G., an agreement was sealed with the Bournemouth and Poole Electricity Supply Co. to light the workhouse with electricity.

Colwyn Bay.—At a meeting of the Council last week, the manager of the electricity works reported that he had gone into the question of lighting the Cayley Promenade. As the work could not be done temporarily, it was decided that the matter should be postponed.

Continental Notes.—GERMANY.—A new 10,000-KW. steam turbine and alternator is to be added to the plant at the municipal central station at Chemnitz.

The Frankische Uberlandwerke Gesellschaft is the name of a new company which has just been formed in Nuremburg, with a capital of £200,000 to establish a large central generating station for the supply of current for lighting and power purposes in the Mittelfranken Province. The Schuckert Co. and the Mittelfranken provincial authorities are both financially interested in the new undertaking.

It is reported from Cologne that the Rhenische-Westfalische Electricitätswerke Gesellschaft has decided on the establishment of a large new electricity generating station on the left bank of the Rhine near the Rodder Colliery. The plant, it is said, will comprise two 25,000-H.P. steam turbines.

FRANCE.—A company has just been formed at Orleans, with a capital of £18,000 and the title La Societe l'Electrique de l'Orleanais, to establish a small central station for the supply of electrical energy for lighting and power purposes in the town and district of Orleans.

A hydroelectric scheme of some magnitude, concerning as it will the four departments, Bouches-du-Rhone, Var, Vaucluse and Basses-Alpes, is now under the consideration of a special Commission nominated by the Minister of Agriculture. The scheme proposes to utilise the waters of the Fontaine de l'Evêque, the construction of two dams, and the building of a canal, 58 km. long, to Pourcieux, where water will be distributed by two branches to Var and the Bouches-du-Rhone. The Commission has already formulated a variety of modifications of the original scheme, and joint deliberations are now taking place previous to its final adoption by the Government. This scheme is one of a number submitted, at the invitation of the Minister of Agriculture, by various bodies for dealing comprehensively with the water resources of this part of France.

An understanding has been come to between the Usines de Creusot and the Forges d'Allevard with regard to the establishment at Pontcharra (Isère) of a hydroelectric station and steel works of a large capacity.—*La Lumière Electrique.*

SPAIN.—La Sociedad Energia Electrica de Cataluna has applied for a concession to establish an electric transmission line between Villafrancha del Panade and Perafort, at a pressure of 80,000 volts, and for a similar line at 11,000 volts from Perafort to Tarragona and Reuss, to transmit the current from the Casa Barba central station.

Cromer.—The referendum taken by the U.D.C. on the question of the transfer of the electric light undertaking to Messrs. Edmundsons, has resulted in 314 votes being cast in favour of the transfer, and 273 against, a majority in favour of 41. The replies received numbered 613, of which 26 were invalid, and 405 ratepayers declined to vote. A special meeting, which was called to consider the position on Monday, decided by eight votes to five to proceed with the agreement to transfer the undertaking.

Douglas (Isle of Man).—The Tynwald Court has held an inquiry into the application of the T.C. for a loan of £3,000 for an electric light installation at the Villa Marina. There was no opposition.

With reference to the proposed electric supply for the town, the Corporation has decided to obtain particulars of a scheme from experts, the cost not to exceed £12,000.

Epsom.—Subject to the following amendments, the Highways Committee resolved that consent be given to the prov. order which is being applied for by the Leatherhead and District Electricity Co.: (1) That the mains to be laid within two years should be extended at certain points in Cobham, Oxshott and Great and Little Bookham; (2) that the amount of the deposit (Electric Clauses Act, 1899) be £400; and (3) that the charges should be 6d. and 3d. instead of 8d. and 4d. The company agreed to the extensions, with the exception of Bookham, but refused to agree to a larger deposit than £200, and to a reduction in the charges. A further communication from the Committee to the company was made, but no other negotiations had taken place. Eventually the Council passed a resolution consenting to the order being granted.

Eynsford.—Sir Wm. Hart Dyke is having the electric light installed at Lullingstone Castle.

Grange.—The U.D.C. has decided to inform the Electric Lighting Co. that it will be prepared to give reasonable facilities for the erection and maintenance of electric lighting plant in Grange, and is negotiating for the purchase of a site which it would be prepared to lease for the erection of an electric lighting station.

Hereford.—Electricity is to be substituted for steam for pumping at the waterworks, and a loan of £1,600 is to be applied for by the T.C. for the necessary mains and plant.

Huddersfield.—The local Chamber of Trade has written to the Corporation Electricity Committee calling attention to the Chamber's previous resolution protesting against the profits of the Electricity Department going to the relief of the rates. It contends that the charge for lighting purposes should be reduced.

Kearsley.—The U.D.C. has asked the Lancashire Power Co. upon what terms it would be prepared to supply electricity for the lighting of Kearsley Hall Road and Slackey Brow, in substitution for the present oil lamps.

King's Lynn.—At a recent meeting of the T.C., the engineer submitted an alternative scheme for extensions to the electricity works, embodying the conversion of the gas engines into oil engines to be used as a standby; the extension of the building for additional boilers, and the provision of a boiler and economiser, and necessary pipes, &c., at an estimated cost of £2,000. The engineer's proposals were adopted, and tenders are to be obtained for carrying out the work.

Leith.—The Dock Commissioners have approved of the electrification of the pumping machinery at Alexandra Dry Dock, at a cost of £1,797.

Leyburn.—Two applications for permission to supply current by means of overhead lines at Leyburn have been made to the R.D.C.; one by the Leyburn Mutual Gas Co., and the other by a private company being formed by Mr. Peter Dobson. The Council on Friday last, decided to ask each of the applicants for plans showing where the proposed overhead lines are to be erected.

London.—WOOLWICH.—The Electricity Committee reports regarding negotiations with the Erith U.D.C., with a view to giving the latter a supply of energy in bulk, that it has decided to consult Mr. J. F. C. Snell in the matter and report further. The Committee has also decided to purchase oil switches in connection with the centralisation of the switchboards, which is to be carried out by direct labour, and the electrical engineer has been authorised to accept quotations for all other apparatus that may be necessary to complete the work. The L.C.C. has sanctioned the borrowing of £19,000 on account of the Council's application for £40,000 for the extension of the electricity undertaking at the Globe Lane Works, on the condition that the period of three years, proposed for the repayment of the outstanding debt of £9,228 on obsolete plant, should not commence to run until the extension scheme is completed. Further application is to be made to the L.C.C. for sanction to the borrowing of the following amounts in connection with the undertaking: General mains extensions, £1,500, repayable in 25 years; meters, £630, repayable in 10 years; services, £1,100, repayable in 12 years; and hire-purchase, £2,000, repayable in 10 years.

STEPNEY.—The Electricity Committee has decided to reduce the price of current to consumers whose total accounts for electricity supplied do not exceed £60 per half-year, from 8d. to 7d. per unit for the first 30 hours' use of the maximum demand during each of the six months ending March, and for the first 20 hours during each of the six months ending September, and 1d. per unit for all further consumption in each month. Representatives have been appointed to take part in the conference for the linking up of undertakings in East London in the manner adopted by Poplar and Stepney.

FULHAM.—An expenditure of £40 has been authorised for the purchase of a stock of electric irons, kettles, toasters, &c., to be left on trial with consumers.

Manchester.—The fog last Friday was responsible for a record output from the electricity stations. For the 24 hours ended Friday night the output was 563 092 units, compared with the highest previous record of 550,420 units on December 10th, 1912.

Lowestoft.—The T.C. has referred back for further consideration a recommendation by the Electric Lighting Committee, that to meet the increased cost of materials and coal, and the decreased consumption of current by metallic-filament lamps, the charge for current for lighting be increased from 4½d. to 5d. per unit, with 5 per cent. discount for payment of accounts within a month.

Newport (I. of W.).—The T.C. has accepted the tender of the Isle of Wight Electric Lighting Co., for public lighting for five years, at an annual cost of £390. The arc lamps are to be replaced with four-light lanterns.

Oldham.—The new mill to be erected by the Belgrave Mill Co., Ltd., is to be driven by electric power supplied by the Oldham Corporation.

Paisley.—The electrical engineer has reported that it is desirable that the sub-stations in connection with the works should be enlarged, and that additional transformers up to 200-KW. capacity be installed.

In connection with the electrical supply to the new works of the Seedhill Finishing Co., it is learned that the offer of the General Electric Co. for the necessary transformers and switchboards has been accepted.

Radcliffe.—A new weaving shed belonging to the Co-operative Wholesale Society of Manchester has just been started. There are 500 Northrop automatic looms and some 50 circular-box looms, each having its own motor attached.

The U.D.C. has applied to the B. of T. for an order to permit it to supply current to mills at Ainsworth, in the area of the Bury R.D.C.

Salford.—In a report in regard to the electricity undertaking, the supply of electricity in bulk, and the installation of rotary converter plant, the Electricity Committee informed the T.C. last week, that, having recommended the acceptance of the offer of the Lancashire Power Co. for supply in bulk, it would be

necessary to advertise for tenders for transformers and rotary converters at once. The cost of the machinery and erection would be as follows:—Three rotary converters and transformers, £8,000; high-tension switchgear, £2,000; cable connections and work in connection with installing, £2,000. The Committee recommended that sanction should be sought for borrowing powers. The report was adopted.

The terms under which the Electricity Committee has agreed to purchase energy from the Power Co., are for a one year's supply, £6 per KW. of maximum demand, plus ¼d. per KW.-hour; for two or more years' supply, £3 per KW. of maximum demand for the first 1,000 KW., and £2 per KW. for additional demand up to 3,000 KW., plus ¼d. per KW.-hour. The Corporation requires a minimum of 1,000 KW., an additional 1,000 KW. on 15 minutes' notice, and may want another 1,000 KW. on a month's notice. The company will have over 17,000 KW. of plant installed by the autumn, and it proposes to supply three-phase current at 10,000 volts, 50 periods, over duplicate 2,500-KW. cables to a meter house on the borough boundary, from which place the Salford authorities will deal with it. A lengthy Council discussion took place on the proposal on February 12th, at which Sir William Stevens expressed the opinion that the Manchester terms (which have not been disclosed) would, if understood, be found very similar to those of the company.

Shipston-on-Stour.—The B. of G. has entered into a fresh agreement with Messrs. Brown & Parsons, of Leamington, for electric light at the workhouse. The firm will supply 95 lamps with current for five years at an annual charge of £35, and undertakes to keep the lamps and fittings good for one year. It will lay the supply on free, and will be paid £58 for wiring work and fixing lamps.

Silsden (near Keighley).—Subject to the ratepayers' approval, the U.D.C. has decided to allow the Airedale Shed Co. to produce and sell electrical power to the tenants of Airedale Shed, a proposed new shed company, and any other firms willing to rent power from the company.

South Africa.—Our Cape Town correspondent sends some particulars of an extraordinary occurrence at the Durban power station, where recently an escaped monkey made its way on to the switchboard. The attendants engaged in a cautious but fruitless chase, and finally left the monkey to settle its own difficulties, which it did suddenly by touching some live switch terminals. The monkey was practically burned up, but fortunately the supply was not interfered with.

On January 25th a faulty and condemned H.T. switch was responsible for a 20 minutes' stoppage in the Johannesburg electricity supply to the city and suburbs. The tramways were unaffected.

A meeting of Wellington (Cape Province) ratepayers was held on January 24th for the purpose of discussing an electric lighting scheme. Mr. C. G. Trevett, electrical engineer, was also present, and gave an elaborate explanation of the proposed schemes, one using Diesel oil engines being estimated to cost £9,375, and the other with suction gas engines, £8,780. It was estimated that the annual working costs would be £2,410, and revenue £2,834, leaving a profit of £424. The latter scheme was approved by the meeting.

Swindon.—The T.C. has decided to have the pumping plant at Rodbourne Sewage Works worked by electricity.

Swinton.—The Council has agreed to the Salford Corporation supplying Messrs. Bayley & Craven's Printworks, Pendlebury, with electricity for power and lighting for a period of five years, subject to the supply being turned over to the Council at the end of the term if so desired.

The question of an extension of the use of electricity for street lighting and the improvement of the lighting of roads on the South Lancashire Tramways route by means of metallic-filament lamps on the tramway standards, which has been receiving the attention of the Highway and Lighting Committee of the Swinton and Pendlebury Council, has now been referred to sub-committee.

Troon (Ayrshire).—The T.C. has discussed a proposal to introduce a system of electric lighting for the burgh. In view of the increasing demands made upon the Corporation's gasworks, it is probable an electric lighting scheme will be adopted. Meanwhile, a Committee has charge of the matter.

Tynemouth.—The electrical engineer has been instructed to report as to what reduction in tariffs it will be possible to make, provided not more than £600 of revenue is sacrificed. A scheme by the electrical engineer for electrically lighting the sheds on the Fish Quay is under consideration.

Walsall.—The Corporation has retained the services of Mr. E. M. Lacey, consulting engineer, to report on the electricity undertaking at a fee of 200 guineas.

Whitworth (near Rochdale).—The U.D.C. has decided, on the recommendation of the Tramway Committee, to apply to the L.G.B. for formal sanction to the borrowing of £5,000 by the Council for electrical purposes.

Woking.—As the local Gas Co. has erected three high-pressure lamps, each of 1,500 C.P., and is maintaining these at its own cost, the Council has given permission to the Electric Supply Co. to put up three lamps for the purpose of comparison.

Worsley.—The Lancashire Electric Power Co. has intimated that it will this month undertake the work of extending the supply cables for the lighting of the district, and will, therefore, shortly be in a position to supply the current for the Broak Oak Park extension. Before this latter work can be proceeded with however, an inquiry will have to be held by the L.G.B.

Wrexham.—The R.D.C. has decided to have the new offices lighted by electricity.

TRAMWAY and RAILWAY NOTES.

Argentina.—It is reported from Tucuman that work on the electric tramway from that city to Quebrada de Lules will be commenced in February.

It is expected that the first section of the electric tramways in the city of Salta will be opened to service this month.—*Review of the River Plate.*

Australia.—The tramway authorities have decided to introduce the railless electric traction system into Sydney. Two routes have been selected for trial purposes, and negotiations are proceeding with the agents of the Brush Co. in regard to the equipment, &c.

Barnsley.—A considerable scheme for linking up by railless trolley cars the mining townships of South Yorkshire, is in course of negotiation between the Barnsley Corporation, neighbouring District Councils and West Riding Tramway undertakings. The reason for the scheme seems to be the stubbornness of the railway companies in refusing to give satisfactory facilities for the district, and the places affected are Barnsley, Thurnscoe, Bolton-on-Dearne, Hoyland, Birdwell, Wombwell, Darfield, Cudworth, Grimethorpe, Smithies, Carlton and Royston.

Bingley.—The District Council, on the recommendation of the Finance and General Purposes Committee, last Monday approved of terms of agreement, announced some weeks ago, with the Bradford Corporation for the leasing of proposed electric tramways between Nab Wood terminus of the Bradford routes and Bingley.

Bolivia.—A law has been passed authorising the Government to contract with the Electric Light and Power Co., of Cochabamba, for the following electric railway lines:—(1) The extension of the company's existing Vinto-Arani line to Totora; (2) the construction of a line from Cochabamba to Sacaba; and (3) the extension of the Cochabamba-Vinto line to Sipesipe.

Bradford.—Owing to the great variation in working hours, and the consequent difficulty in issuing passes, the Corporation Tramways Committee has recommended to the City Council that, in lieu of the present system of allowing school children and juvenile workers to travel, between certain specified hours, at half-fares, all young persons between the ages of five and sixteen years shall travel half-fares, and that children under five shall travel free as before.

Brighton.—The Watch Committee has declined to license 12 new petrol electric buses, belonging to a private firm, to ply in the borough.

Bristol.—At the meeting of the Council, a thoroughly representative Committee was appointed to consider the desirability of exercising an option to purchase the tramway undertaking within the city.

Continental Notes.—HOLLAND.—Plans are being prepared in respect of a projected electric tramway between Arnheim and Vepl, and also for a proposed line between Oosterbeek and Arnheim.

RUSSIA.—A preliminary concession has been granted in respect of a projected electric railway between Tiflis and Vladicancas.

SWITZERLAND.—An electric railway of some international importance is projected from Nyon to Morez by the way of Arzier, Saint Cergue and La Cure, towards the cost of which the Grand Council of the Canton of Vaud has just voted the sum of £33,304. The line will be worked on the overhead trolley system, and will be 40 km. long, but by a junction with the French railway network at La Cure will have a development of 24,000 km., serving a large and populous area on both French and Swiss territory.—*La Lumière Electrique.*

Dundee.—Reporting on the proposed extension of the railless trolley system from Clepington Road to Lochee, Mr. P. Fisher, the tramway manager, said he did not think the installation would be self-supporting in the early stages, but it certainly would act as a feeder to existing services, and on the whole it would not be a serious burden to the tramway undertaking. Regarding a proposal to call upon the tramways department to contribute towards the maintenance of the road, Mr. Fisher pointed out that in every case where Parliamentary powers had been applied for to work this form of traction outside the boundaries of the authorities making the application, attempts had been made to get clauses introduced for the purpose of compelling the promoters to contribute towards the maintenance of the roads. Parliamentary Committees in every

case refused to look upon the running of railless cars of the passenger type as extraordinary traffic. This form of traction did less damage to a roadway than any form of mechanical traction where the prime mover was carried on the vehicle. Mr. Johnston, convener of the Tramways Committee, claimed at a meeting of the Committee that the railless cars had proved a convenience to the public. While the return per mile was not very high, the expenses were not great. Another member held that the experience of the past four months had shown that the trackless trolley car had come to stay. The extension was approved of, but it was decided to delay it until the question of road maintenance had been settled.

The tramway manager has been instructed to report upon the Craig Pier route, it being alleged that there is an annual loss on this branch of about £1,200.

Cardiff.—Notwithstanding the fact that the estimated expenses of the tramways department show an increase of £3,163 over last year's estimate, chiefly owing to the rise in wages, an increase of £7,175 is anticipated in next year's income, and an estimated surplus of £13,280, as against an estimated surplus of £9,268 in 1912-13, and an actual surplus of £11,218 in 1911-12.

Dutch East Indies.—The Samarang Joana Steam Tram Co. is making arrangements to improve its system of tramways in the town of Samarang by electrifying them. Particulars in regard to the contracts to be issued for carrying out the work have been submitted for the approval of the communal authorities.—*Board of Trade Journal.*

Great Yarmouth.—The T.C. has decided to double the tramway track in the Market Place, at Theatre Plain, and through Regent Road, at an estimated cost of £8,750.

Halifax.—The receipts in connection with the working of the Halifax tramways since April 1st last, the commencement of the municipal year, have shown an increase on those of the preceding year of £2,683, though the period has only been one of 317 days, as against 319 days. The figures, up to the latest report for year, are £91,639, as against £88,956.

Ilford.—It has been decided to abandon the idea of extending the tramway system, and of running railless trolley vehicles, in favour of using motor-'buses. The question of removing the centre tramway columns in the High Road is under consideration.

London.—According to the *Evening Standard*, a Bill is to be introduced shortly for the construction of underground railways for the conveyance of mails and parcels in London. The original scheme was outlined in these columns at the time of the Departmental Committee's report on the matter. It contemplates 6½ miles of 7 ft. 6 in. diameter double track tube to be electrically operated and automatically controlled; the estimated cost is £530,000.

Oldham.—A proposal, by no means new, has been put forward that greater use might be made of the tramways for the carriage of goods during the night. If the suggestion could be carried out, the great industrial areas round Oldham, Rochdale and Manchester could be linked up, and goods could be conveyed to the docks of the Manchester Ship Canal. It is claimed that by this means business men would not meet with the frequent and long delays now suffered in the carriage of goods on the railways.

At a meeting of the Tramways Committee, the tramways manager, referring to the equipment of the long saloon bogie cars with four motors, said statistics showed that with four motors the car consumed 2·40 units per mile, and with the new equipment, the 40 H.P., it was only 1·46. Taking all things into consideration, he thought it would pay them to abandon all the four motor equipments and go to the single motor. They would save nearly half the current consumption for a start. To alter the cars to the single motor would cost about £245 per car. It was decided that in regard to six of the saloon cars the manager's suggestion should be carried out.

Salford.—The Corporation is appealing against the assessment of its tramways within the Barton Union, and litigation is pending on the subject. It is understood that the difficulty is upon the method of assessment.

Southport.—The Council has decided to take a referendum vote of the ratepayers on the question of Sunday running of the Corporation cars; the local company's cars already run on Sunday.

Tynemouth.—The local tramway company has again approached the T.C. to reopen the question of providing an extension to Preston; the Parliamentary Committee has expressed its willingness to consider the matter.

Uruguay.—It is reported from Monte Video that construction will shortly commence on the electric railway from Monte Video to Maldonado and Puente del Este. There will be a double line, and it is hoped to maintain a speed of about 100 km. an hour. The line will be built at a distance of 1 to 2 km. from the coast, and will go through a district susceptible of cultivation. It will pass near the Piriapolis seaside establishment. The generating station is to be at Maldonado. The line will afterwards be prolonged to La Paloma and Rocha.—*Review of the River Plate.*

Worsley.—The South Lancashire Tramways Co. has deposited with the U.D.C. a plan of a length of tramway in Manchester Road connecting with the proposed new line through Little Hulton.

TELEGRAPH and TELEPHONE NOTES.

Australia.—The Commonwealth Government has published the specifications for the power generating plant for the wireless station to be erected at Darwin, of 1,500 to 2,000 KW., to communicate with Singapore, and thus to connect Australia with the Imperial wireless chain.

The new cable of the Pacific Cable Board between Auckland and Sydney is now open for public business.

Canada.—The Province of Manitoba will spend £205,000 on extensions to the Government telephone lines this year.

France.—It is intended to erect a wireless station at Bouin, on the island of that name, lying off the Department of the Vendée.—*La Lumière Electrique.*

Glasgow.—The T.C.'s Special Committee on Telephones, having considered the question of junction fees between exchanges in the city telephone district and suburban telephone districts, has instructed the town clerk to write to the Postmaster-General and urge upon him the desirability of having these fees abolished and of having the city, as extended by the Glasgow Boundaries Act of 1912, embraced within one telephone district.

Hull.—The Corporation Telephone Committee, after negotiations with the Postmaster-General, has passed a resolution to the effect that, subject to terms being agreed upon, the Corporation is prepared to purchase from the Post Office the plant acquired by the latter from the National Telephone Co. in its area, and to apply for a new licence. It is understood that the Postmaster-General will not grant a new licence unless this is done. The price to be paid for the undertaking is that which the Government paid to the company, with allowance for depreciation

Imperial Wireless System.—In reply to Major Archer Shee in the House of Commons, the Postmaster-General stated that the Scientific Committee had informed him that after consideration of the statements of representatives of firms who had been invited to give evidence as to the capabilities of their systems of long-distance wireless telegraphy, it had decided to treat the evidence as confidential.

The second interim report of the Select Committee on the Marconi contract was to the effect that the Committee had not had time to complete the inquiry, and recommended that a committee should be re-appointed next session. At the last sitting, on Wednesday last week, Mr. Oliver was again examined with regard to the sources of the rumours which he had heard, connecting members of the Government with dealings in Marconi shares. The witness said he could not recollect the names of any of the persons who gave him the information. He could not name any person who, to his knowledge, had benefited to a considerable extent by Marconi shares. Mr. L. J. Maxse, editor and proprietor of the *National Review*, was then called, and stated that when his attention was called to the matter in July, 1912, and he began to make inquiries, everything he heard went to show that there was something curious about it. The gambling in the shares of the company indicated leakage from somewhere, and the evasive replies of Ministers to questions in the House of Commons added to the mystery. Hundreds of thousands, perhaps millions, of pounds changed hands, to the immense advantage of those who were "in the know." The Postmaster-General could have stopped it if he had frankly stated the facts. There was nothing to explain the action of the Post Office in surrendering to Mr. Godfrey Isaacs. Ministers were primarily responsible for any suspicions that had been rife. Mr. Isaacs should not have taken part in the negotiations while his brother was Attorney-General. The rumours about particular Ministers (not the Postmaster-General) were persistent, and the public were uneasy about the matter. Several people, some of whom were Members of Parliament, had called the witness's attention to the subject. He was willing to state the purport of their communications, but he refused to divulge their names, as to do so would be a breach of confidence. The information he had received showed that there was strong ground for suspicion that Ministers had been gambling in Marconi shares; but he had no actual evidence.

The Committee, after long consideration and discussion, decided to report the witness to the House of Commons. This was done, but in view of the late stage of the session the Government decided to take no immediate action in the matter.

The Postmaster-General has again refused the Marconi Co.'s application for release from the contract.

The Sounder in Submarine Telegraphy.—It is announced in the annual report of the Commercial Cable Co. that Mr. John Gott, their chief engineer, has invented a device which enables the ordinary Morse signals to be sent over long submarine cables with the ordinary landline key and received on the Morse sounder, the invention thus constituting an immense advance on present conditions. The company has acquired the rights to manufacture the device, which is patented in all countries.

It is reported that the essence of Mr. Gott's system is the use of successive currents of alternate polarity in transmitting the signals, the four dots in the letter H, for example, being produced by two positive and two negative currents acting alternately; the discharge from the cable is used for effecting the reversal of the current after each signal, and the apparatus required is inexpensive.

Messages have already been transmitted from London to New York on the new system, and the use of automatic repeating relays rendered possible by the adoption of the new system has greatly increased the speed of transmission, whilst eliminating errors due to manual repetition.

The Telephone on Board Ship.—The three great liners of about 50,000 tons each, which have been ordered by the Hamburg-America line, are going to be fitted out with telephone exchanges of the most modern type, to which each cabin will be connected. The order for the installation has been given to Messrs. Siemens & Halske, of Berlin.

Trans-Pacific Wireless.—The *Electrical World* states that the Marconi Wireless Telegraph Co. has placed contracts with the J. G. White Engineering Corporation, of New York, for the erection of eight wireless stations, two pairs for Atlantic and two pairs for Pacific service. Receiving and sending stations, 30 miles apart, will be erected at Oahu, in the Sandwich Islands; Tamales Bay and Bolinas, California, near Belmar, N.J.; and in eastern Massachusetts. These stations will form part of a globe-girdling system, which will continue to the East by way of Japan, and thence ultimately to India. Twelve towers, 400-450 ft. high, will be spread out over a semi-circle covering a square mile at each station, and it is estimated that the range of each station will be from 4,000 to 6,000 miles.

United States.—The fast scout cruiser *Salem* has been ordered on a voyage across the Atlantic to test the transmitting capacity of the United States Government's new wireless telegraph station at Fort Myer, near Washington, D.C. Continuous tests are to be made throughout a radius up to 4,000 miles, although it is expected that even this range will be exceeded. Eventually it is hoped that this powerful new station will be able to communicate with any ship of the United States Navy, using intermediate vessels as relays for distances above 3,000 miles.—*Electrical World.*

The *Electrical World* states that the Telefunken station at Sayville, Long Island, N.Y., is in daily communication with ships on the Atlantic, and South American ports, having a range up to 5,800 km. The longest distances are covered with a 35-KW. plant, using a wave-length of 2,800 m.; for the shorter distances a 5-KW. plant with a wave-length of 600 m. is used.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 3rd. Service materials, for the U.D.C. electricity department. See "Official Notices" February 14th.

Aberaman.—March 10th. Electrical goods, for the directors of the Powell Duffryn Steam Coal Co., Ltd. Stores Manager, Aberaman, near Aberdare.

Argentina.—April 15th. Tenders will be received at the Dirección General de Minas, Geolgía e Hidrología, Buenos Ayres, for the supply of motors, cables, dynamos and kindred material required for the generation of motive power.—*Board of Trade Journal.*

Australia. — WESTERN AUSTRALIA. — February 27th. Buildings and boiler-house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" January 24th.

SYDNEY.—March 17th. Motors for the City Corporation.

SOUTH AUSTRALIA.—March 5th. One section of a common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" January 31st.

COMMONWEALTH GOVERNMENT.—Darwin power station, about 2,000 KW. Equipment to comprise Diesel oil engines and accessories and overhead travelling crane, alternators and exciters, and switchboard.

NEW SOUTH WALES GOVERNMENT RAILWAYS.—March 5th. Twelve single-phase transformers, and one 12½-KW. generator. Specifications 388 and 389 (2s. 6d. each) from Electrical Engineer's Office, 61, Sydney.

Barrow-in-Furness.—March 3rd. Electrical stores for a year, for the T.C. Borough Electrical Engineer.

Bedwas.—March 5th. Electrical goods for a year, for the Bedwas Navigation Colliery Co., Ltd. (Form 4). The Secretary.

Belfast.—February 24th. Stores and materials for one or three years, for the City electricity department. See "Official Notices" January 31st.

Birmingham.—March 1st. Electrical stores for a year, for the Birmingham, Tame and Rea District Drainage Board. Mr. John D. Watson, engineer, Tyburn.

Bolton.—February 24th. Materials and stores, for the Corporation Tramways Department. See "Official Notices" February 7th.

Bulgaria.—SOFIA.—March 3rd. Tenders are invited for 100,000 insulators and 100,000 kg. galvanised iron wire. Particulars, Post and Telegraph Direction Sofia, Bulgaria.

Colchester.—March 10th. Sundry stores for the Corporation Electricity Department. Mr. W. Frisby, electrical engineer, Osborne Street.

Croydon.—March 31st. Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

February 24th.—Sinking artesian well and supply of pump, for the Corporation electricity works. See "Official Notices" Feb. 14th.

Dinas (near Porth).—Refuse destructor and electrical generating works, Appletree, for the Rhondda U.D.C. Messrs. Robert Hammond & Son, 64, Victoria Street, S.W.

Dukinfield.—Electrical work required for the new Primitive Methodist School, Dukinfield. Messrs. J. H. Burton and J. A. Percival, architects, 150A, Stamford Street, Ashton-under-Lyne.

Dundee.—The Corporation Tramways Committee invites tenders for supply of stores for a year. Mr. Peter Fisher, general manager.

March 7th.—Two water-tube boilers, &c., mechanical stokers, economiser, steel bunkers and coal-handling plant, for the Corporation electricity department. See "Official Notices" to-day.

Edinburgh.—The Corporation invites offers for works and supplies, including upholding house telephone and electric bell installations at City Hospital, electrical material for interior wiring and jointing, and insulating material for electricity supply cables. Resident Electrical Engineer, Dewar Place.

Edmonton.—February 26th. Electric lamps for the B. of G. Mr. F. Shelton, clerk, The Grange, White Hart Lane, Tottenham.

Erith.—March 6th. Electrical work for three years, under U.D.C. assisted wiring scheme. See "Official Notices" to-day.

G.C.R.—March 4th. The Great Central Railway Co. are inviting tenders for stores during the year ending April 30th, 1914. (15) Electric light wires and cables; (16) electric light globes and shades; (17) electric light carbons; (18) casing, accessories and lamps; (60) telegraph materials. Samples may be seen, up to March 3rd, at the Conservative Club, Gorton Lane, Gorton, Manchester, and specifications and forms of tender can be obtained from Mr. W. Williams, Stores Superintendent, Gorton, Manchester. Applications, stating number of specification, should be accompanied by an addressed foolscap envelope, properly stamped.

Germany.—February 28th. The Finance Deputation of Hamburg is inviting tenders for the supply and erection of a 30-ton electric crane.

March 10th.—The lighting and water supply authorities of Bremen are inviting tenders for several heavy-oil engines and dynamos for the Hastedt central electric lighting station.

Glasgow.—February 26th. The T.C. invites offers for the various works required in connection with the erection of a dispensary at St. Rollox. Specifications, &c., from the Town Clerk, City Chambers.

Heston and Isleworth.—March 8th. Stores and materials for a year, for the U.D.C. electricity department. See "Official Notices" to-day.

Hornsey.—February 24th. Electricity meters, cables and cable stores, for the T.C. See "Official Notices" February 7th.

Ilford.—March 1st. Council Education Committee. Tenders for the electric lighting installation at the South Park School extension, Water Lane, Ilford. Mr. C. J. Dawson, architect, 11, Cranbrook Road, Ilford.

February 25th.—Stores for a year, for the U.D.C. electricity department. See "Official Notices" February 7th.

India.—March 14th. Motors, transformer and motor-generator, for the B.B. and C.I. Railway. See "Official Notices" to-day.

March 4th.—Starting and controlling pillars, for the Bombay, Baroda and Central India Railway. See "Official Notices" to-day.

King's Lynn.—March 1st. Lancashire boiler, economiser and pipework, for the Corporation Electricity Department. See "Official Notices" to-day.

Liverpool.—February 24th. Two steam engines and dynamos (50 KW.), switchboard, motors, wiring for 1,500 lamps, motors, &c., in connection with the electric light and power installation at the Toxteth Union Workhouse and Infirmary, Smithdown Road. Mr. T. L. Miller, consulting engineer, 709, Tower Buildings, Liverpool.

London.—L.C.C.—February 25th. Electric wiring of the Camberwell and Cressy Road car-sheds. See "Official Notices" January 31st.

February 25th.—Three 1,500-KW. rotary converters, nine transformers for rotary converters, and two starting transformers. See "Official Notices" February 14th.

February 26th.—Electrical installation at Leipsic Road Elementary School, Camberwell, S.E. See "Official Notices" Feb. 14th.

March 4th.—Two 8,000-KW. turbo-generators, with condensing plant, &c. (extension of time). See "Official Notices" to-day.

March 5th.—Electrical installation at the Curtain Road Elementary School. See "Official Notices" to-day.

ST. PANCRAS.—March 4th. Arc lamp carbons, for the B.C. See "Official Notices" February 7th.

MARYLEBONE.—February 26th. Stores and materials for a year, for the B.C. Electricity Department. See "Official Notices" February 7th.

SHOREDITCH.—February 24th. Two economisers (Green type), for the B.C. electricity department. See "Official Notices" February 14th.

STEPNEY.—March 17th. Boilers and boiler house accessories, turbo-alternators, condensers, accessories and switchgear, for the B.C. See "Official Notices" February 14th.

Manchester.—Corporation. Steel girder tramway rails. J. M. McElroy, manager.

Neath.—March 3rd. One 400-KW. high-speed engine, direct-coupled to a two-phase alternator, and accessories, for the B.D.C. See "Official Notices" February 14th.

Newport (Mon.).—March 4th. Electric light fittings for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

February 22nd.—Stores for a year, for the Corporation Electricity and Tramways Committee. See "Official Notices" Feb. 14th.

Pontypridd.—March 5th. Stores and materials for the U.D.C. electric light and tramways department. See "Official Notices" to-day.

Swindon.—March 8th. General stores and materials for a year, for the Corporation electricity and tramways departments. See "Official Notices" February 14th.

March 10th.—One 500-KW. mixed-pressure turbine and condensing plant, boiler feed pump and pipework, and one switchboard panel and cables, for the Corporation. See "Official Notices" February 14th.

Swinton and Pendlebury.—March 10th. One 25-KW. transformer and switchboard, main along Chatsworth Road, and annual supply of materials, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

Wallasey.—March 15th. Fuel oil (400 tons) for a year, for the Corporation electricity department. Mr. J. A. Crowther, electrical engineer, Seaview Road, Liscard.

Walthamstow.—February 28th. Four double-deck tramcars complete with magnetic-brake equipments, for the U.D.C. See "Official Notices" February 7th.

Warlingham.—February 24th. Electric light sundries for the Mental Hospital, for Croydon T.C., for a year. Mr. F. C. Lloyd, Town Clerk, Town Hall, Croydon.

Warrington.—March 5th. Motors and transformers for a year, for the Corporation. See "Official Notices" Feb. 14th.

Wigan.—February 24th. High-tension three-core feeder cable, transformer and switchgear, for the Corporation. See "Official Notices" February 14th.

Wimbledon.—March 5th. Stores and materials, for a year, for the Corporation Electricity Department. See "Official Notices" February 14th.

Wrexham.—March 1st. Stores for a year, for the Borough Electrical Engineer's department. See "Official Notices" February 14th.

York.—March 10th. One 3,000-KW. turbo-alternator, with condensing plant, pipework and switchboard, water-tube boilers with chain-grate stokers, &c., storage battery and H.T. cables, for the Corporation. See "Official Notices" to-day.

CLOSED.

Aberdeen.—The Corporation Electricity Committee has accepted the offers of the Oerlikon Co. and Messrs. Bruce Peebles and Co., for additional generating plant. The cost of the new plant is £11,000.

Atherton.—The Electricity Committee of the U.D.C. has accepted the tenders of the W. Rose Hose Co., Ltd., and Messrs. F. Reddaway & Co., Ltd., for new fire hose.

Austria.—The adjudication on the tenders for glow lamps for the North, South, State and other Austrian railways for the current year has resulted again in favour of the latest pattern of the Westinghouse tungsten-wire lamp.

Barnsley.—For the Corporation electricity station Messrs. E. Bennis & Co. have received an order for two of their stokers and self-cleaning compressed-air furnaces.

Bolton.—The contract for an electric light installation at shop premises at 134, St. George's Road, is being carried out by the Charleson Accumulator Co., of Bolton.

The Corporation electricity department has ordered a "Bennis" ash elevator and bunker.

Dewsbury.—The T.C. has accepted the tender of Messrs. Babcock & Wilcox, Ltd., for new boilers for the electric light works, at £1,782.

Ealing.—The B.C. has accepted the tender of Messrs. Ferranti, Ltd., at £1,978, for a new generator switchboard.

France.—There has just been placed with Messrs. E. Bennis & Co., Ltd., by the Mines de Dourges electric station, a contract for 16 "Bennis" high-duty coking stokers and self-cleaning compressed-air furnaces. This is a second repeat order, the machines having given every satisfaction in dealing with low-grade coal abroad.

Glasgow.—The Electricity Committee had divisions in connection with the placing of the contracts for the supply of boilers for Port Dundas and St. Andrew's Cross stations. In the former case it was proposed that the offer of Messrs. Howden & Co., Ltd., for four water-tube boilers, at £13,120, be accepted, while the amendment was that the offer by Messrs. Babcock & Wilcox, Ltd., amounting to £13,748, be agreed to. A second amendment proposed to give two boilers each to the competing firms. On a vote, it was decided by a clear majority to accept Messrs. Babcock and Wilcox's offer. So far as the St. Andrew's Cross offers were concerned, the proposal was the acceptance of Messrs. Babcock and Wilcox's offer to supply four small boilers, at £7,158, while the amendment was that Messrs. Babcock & Wilcox's offer and that of Messrs. Howden—the latter amounting *in toto* to £6,910—be accepted for two boilers each. The proposal was adopted.

At its last meeting, the T.C. remitted back to the Electricity Committee the proposals in connection with the placing of contracts for two turbo-generators and condensing plant, and a report by the engineer (Mr. W. W. Lackie) has been considered by the Committee. The original recommendation, as published in the REVIEW, was that an offer by Messrs. Willans & Robinson, Ltd., for one set of Curtis-Parsons turbo-alternators and condensing plant, amounting to £16,064, and an offer by the British Westinghouse Electric and Manufacturing Co., Ltd., for one set of Curtis-Rateau turbo-alternators and condensing plant, amounting to £16,721, be accepted. The engineer gave an exhaustive opinion, based on experience, in which he reviewed all the tenders submitted. It having been decided in committee to proceed with the selection of the offers, it was proposed that the offer made by (*a*) the British Westinghouse Electric and Manufacturing Co., Ltd., for one set of Curtis-Rateau turbo-alternators and condensing plant, amounting to £16,721, and (*b*) Messrs. Howden & Co. for one set of Rateau-Zoelly turbo-alternators and condensing plant, amounting to £17,793, be accepted. The amendment, that the former recommendation be reaffirmed, was carried by 15 votes to 6.

It is recommended by the T.C.'s Committee on Tramways that the following contracts be accepted :—

Steel plates for manholes.—William Baird & Son.
Section pillar castings.—Walter Macfarlane & Co.
P.B. flanged lampholders.—Edison & Swan United Electric Light Co., Ltd.
Insulated stud bolts.—W. C. Yuille & Co.

Government Contracts.—The following tenders have been accepted during the past month by the Government departments named :—

ADMIRALTY: CONTRACT DEPARTMENT.

Incandescent lamps.—General Electric Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.

Switches and sockets, &c.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Edison & Swan United Electric Light Co., Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; Hawkers, Ltd.; McGeoch & Co., Ltd.; Player and Mitchell; Walsall Electrical Co., Ltd.; Westminster Engineering Co., Ltd.

WAR OFFICE.

Rewinding generators.—British Westinghouse Electric and Manufacturing Co., Ltd.

INDIA OFFICE: STORES DEPARTMENT.

Batteries.—Tudor Accumulator Co.
Dynamos.—J. Stone & Co.
Engines.—Lancashire Dynamo and Motor Co.
Insulators.—Bullers, Ltd.
Lamps.—J. Stone & Co.
Switchboards.—Eckstein, Heap & Co.
Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co.

OFFICE OF WORKS.

Carbons for arc lamps.—General Electric Co., Ltd.

GENERAL POST OFFICE.

Protective apparatus and telephonic apparatus.—British L. M. Ericsson Manufacturing Co., Ltd.

Telephonic apparatus.—Western Electric Co., Ltd.

Telegraph cable.—British Insulated and Helsby Cables, Ltd.

Telephone cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; J. C. Fuller & Son, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; London Electric Wire Co. and Smiths, Ltd.; Peel-Conner Telephone Works, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.

Stoneware ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.

Telegraph ironwork.—Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.; Walls, Ltd.; D. Willetts, Ltd.

Bronze wire.—T. Bolton and Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. and Smiths, Ltd.).

Flame-proof wire.—C. Macintosh & Co., Ltd.

Electrically lighting Birmingham Stores, Block "C."—Pinching & Walton.

Electric lifts.—Waverley Station S.O., Edinburgh.—Waygood & Co., Ltd.

Telephone exchange equipment, Regent Exchange, W., and Dalston, N.E.—Western Electric Co., Ltd.

Telephone Exchange equipment, South Shields Post Office.—Peel-Conner Telephone Works, Ltd.

Gravesend.—The T.C. has accepted the tender of Messrs. Harrison, Tidswell & Co. for 1,000 tons of coal for the electric light works, at 16s. 6d. per ton.

Hereford.—The extension to the electric lighting installation in the County Surveyor's Department at the Shire Hall is being carried out on the Henley H.W.S. system using Holophane bowl fittings, by Messrs. Walker & Co.

Heywood.—The Electricity and Tramways Committee has contracted with the Tudor Accumulator Co. for repairs to the accumulators (£80 to £90).

Ilford.—The U.D.C. has placed an order with Messrs. Watlington & Co. for bracket arms for the Tramways Department, at 8¾d. per foot.

Ipswich.—The T.C. has accepted the tender of Messrs. Sulzer Bros. for a Diesel oil engine coupled to a high-lift centrifugal pump, at £2,370.

Keighley.—The Keighley and Bingley Joint Hospital Board has accepted the tender of Mr. H. Spencer for electrical work at the hospital.

London.—BERMONDSEY.—The Electricity Committee reports having had under consideration the necessity of improving the arc lamp lighting of the borough, and, with this purpose in view, had been testing all the best known makes of arc lamps, with the result that the following tenders have now been received:—

Crompton & Co., Ltd.—(*a*) 170 arcs erected complete, so that same are in every respect ready for working, £1,280 (slight reduction if existing line resistance is used); (*b*) five spare arcs, £29 10s.; (*c*) one year's supply of carbons, £16 18s. per 1,000 pairs; (*d*) price to be allowed for existing arc lamps, £157.

Engineering and Arc Lamp Carbons, Ltd.—(*a*) £1,362; (*b*) £37 15s.; (*c*) £9 3s. 6d.; (*d*) £87 10s.

Johnson & Phillips, Ltd.—(*a*) £1,615; (*b*) £47 10s.; (*c*) £4; (*d*) 15s. each.

General Electric Co., Ltd.—(*a*) £1,568; (*b*) £45; (*c*) £5 5s.; (*d*) 10s. each.

Oliver Arc Lamps, Ltd.—(*a*) £1,249; (*b*) £35; (*c*) £2 15s.; (*d*) £106 5s.

Jandus Arc Lamp and Electric Co., Ltd.—(*a*) £1,224; (*b*) £35 10s.; (*c*) £31 17s.; (*d*) £131.

The Committee has decided to accept the offer of Messrs. Johnson & Phillips, Ltd.

HOLBORN.—The B.C. has accepted the tender of Messrs. Barlow Bros. & Co., at £55, for wiring the public mortuary. Other tenders were received from Messrs. Rashleigh, Phipps & Co., at £64 15s.; Messrs. Willats & Son, at £62 10s.; and Messrs. Duncan Watson and Co., at £66 8s.

WOOLWICH.—The B.C. has accepted the quotation of Messrs. Ferranti, at £74, for oil switches.

Paisley.—We understand that Messrs. James Kilpatrick and Sons have secured the contract for the electrical work required in the proposed church at Wallneuk.

Salford.—The Electricity Committee has accepted the tender of Messrs. Mather & Platt, Ltd., for filtration plant at the electricity works, Frederick Road, for £635.

South America.—Messrs. Gillespie & Beales, London, buying engineers for Messrs. Martin Bros., Valparaiso, have recently placed the following order with Messrs. Lindsay, Burnet and Co., Govan:—For ss. *Taltal*, two main boilers, complete with tanks and oil-burning apparatus on the Korting system, complete with all accessories; one donkey boiler, fitted for coal or, alternatively, oil burning.

Wakefield.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for reinsulating an alternator at the generating plant, at £163.

Yarmouth.—The T.C. has accepted the tenders of Messrs. Bradbury, Son & Co., Ltd., for 500 tons of hard steam coal, and Messrs. Wm. Cory & Son for 650 tons of Digby and Pooley Hall slack coal, for the Electricity Department.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 21st. At 7.30 p.m. At the Lit. and Phil., Newcastle. Lecture on "Surface Combustion," by Prof. W. A. Bone.

Royal Institution.—Saturday, February 22nd.—At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir. J. J. Thomson. (Lecture III.)

Saturday, March 1st.—At 3 p.m. Lecture on "The Properties and Constitution of the Atom," by Prof. Sir J. J. Thomson. (Lecture IV.)

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, February 24th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "A Single-Phase Traction System," by Mr. V. O. Haddock.

(Manchester Section).—Tuesday, February 25th. At 7.30 p.m. At the University, Manchester. Paper on "Some Recent Developments in the Manchester Street Lighting," by Messrs. S. L. Pearce and H. A. Ratcliff.

(London).—Thursday, February 27th. At 8 p.m. Fourth Kelvin Lecture on "The Ohm, the Ampere and the Volt—a Memory of Fifty Years, 1862-1912," by Dr. R. T. Glazebrook.

(Students' Section).—Wednesday, February 26th. At 7.45 p.m. At the Institution, Embankment, W.C. Adjourned discussion on paper on "Some Problems of Electricity Supply," by Mr. G. W. P. Page.

Electro-Harmonic Society.—Tuesday, February 25th. At 8 p.m. At the Holborn Restaurant. Ladies' night.

Physical Society.—Friday, February 28th. At 5 p.m. At King's College, Strand, W.C. Papers on "Interference by Röntgen Radiation," by Prof. C. G. Barkla and G. H. Martyn; "Alternating-Current Magnets," by Prof. E. Wilson; and "A Graphical Method of Optical Imagery," by Mr. W. R. Bower.

Salford Technical and Engineering Association.—Saturday, March 1st. At 7 p.m. At the Royal Technical College, Salford. Lecture on "Wireless Telegraphy," by Mr. J. McKeever.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, February 24th.—"A" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Tuesday, February 25th.—"B" Company. Company training, 7 to 10 p.m.

Thursday, February 27th.—"C" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Saturday, March 1st.—(Left Half Battalion). "C" and "D" Companies. Week-end training at Dover. Dress:—Service dress, putties and great-coats. No arms will be taken. Parade at Victoria Station, S.E. and C. Railway, at 1 p.m.

Headquarters will be open from 10 a.m. till 12 noon for regimental business.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.
For Officer commanding L.E.E.

NOTES.

Electric Drive in the Wood-working Yard.—Referring to the article on this subject published in our issue of January 24th, we are informed that a clerical error was made in quoting the cutting speed of the horizontal reciprocating saw of Messrs. John Pickles & Sons' make. The saw was mentioned as being driven by a 15-H.P. motor, and it was stated that it was "capable of making one cut up to 48 in., cutting at the rate of 2 in. per minute." This should have been 2 ft. per minute.

Parliamentary Notes.—ADMIRALTY ELECTRICAL ENGINEER.—In Friday's Parliamentary Papers, Major Archer Shee asked the First Lord of the Admiralty whether the services of the chief electrical engineer had been lent to the Leeds Corporation: and if so, why this gentleman's services could be spared, in view of the Admiralty statement that it was not desirable that they should undertake the erection of wireless stations, as they could not spare their staff. Mr. Churchill replied that the circumstances referred to had not been previously brought to his notice. He was informed that the services of the superintending electrical engineer had not been lent to the Leeds Corporation, but that he had accepted an invitation unofficially to give an opinion on certain points connected with their electrical undertaking on which the advice of an impartial expert was desired. The acceptance by a servant of the Crown of employment such as this, which did not interfere with the performance of his official duties, was not actually prohibited by the regulations. The position of scientific experts in the service of the State presented special features, and he saw no reason to interfere with the arrangement made in this particular case. At the same time, he had given instructions that in future the consent of the head of the department must be obtained by an officer before undertaking any service of this character.

ELECTRICITY IN MINES.—On the motion for the adjournment of the House of Commons on Friday night, Sir A. Markham called attention to the Rufford Colliery disaster, which resulted in the death of 14 men. The disaster was caused by a hoppet, which broke through the headgear of the colliery, and a barrel containing some tons of water was precipitated down the shaft on to the men. Not a single man was struck by the hoppet but the deaths were caused by drowning. When the hoppet came down all the lights

in the shaft were put out, and the hon. member said that if electric lamps had been provided in the mine he felt sure that the majority, if not all, of the men would have been saved.

Standing Orders.—The whole of the 112 private Bills deposited in the Private Bill Office for consideration by Parliamentary during the forthcoming session have now been before the Examiner and dealt with, with the exception of three, which have been postponed till March 4th. One of the postponed Bills is the London County Council Tramways and Trolley Vehicles Bill. Four Bills will not be proceeded with, one of which is that of the Halifax Corporation for powers to construct about 12 miles of new tramways, at a cost of about £200,000. In six cases, the promoters have failed to show proof of having complied with Standing Orders, and these Bills will accordingly have to go before the Standing Orders Committee, who will decide whether they shall be allowed to proceed. One of these is the Ely Valley Gas and Electricity Bill, where it was held that the notices did not sufficiently and accurately define the area proposed to be supplied with gas and electricity by Clauses 25 and 53. By Clause 58 it was proposed that the company should be under obligations similar to that provided for under Sub-Sec. 1 of Sec. 21 of the Schedule in the Electric Light Clauses Act of 1899, to lay down distributing mains in certain streets and roads mentioned in the second Schedule of the Bill, but as such streets and roads were not specified, it was held that the promoters had failed to comply with the standing orders. It was also held that the Leeds Corporation had failed to comply with the Standing Orders by not having the consent of the West Riding County Council, who are the road authorities, in respect of Tramway No. 6 in the Bill. This proposed tramway was one of 1 mile 5 furlongs to be constructed in the city and in the township of Templenewsam, in the rural district of Hunslet.

Amongst the Bills dealing with electrical matters which have successfully passed the Examiner, and will go for second reading, are the following: Bradford Corporation, Brighton Corporation, Central London Railway, Chesterfield Corporation Railless Traction, City and South London Railway, Cleveland and Durham County Electric Power, Crowborough District Gas and Electricity, Folkestone, Sandgate and Hythe Railless Traction, Hastings Tramways, Herne Bay Gas and Electricity, Huddersfield Corporation, London Electric Railway, Metropolitan District Railway, Metropolitan Electric Tramways, Metropolitan Railway, Mexborough and Swinton Tramways, Northern Counties Electric Supply, Rhondda Tramways, Western Valleys (Monmouthshire) Railless Electric Traction, and Westgate and Birchington Gas and Electricity.

The Batti-Wallahs.—We are informed that the informal meeting of the Batti-Wallah Society, on Wednesday, February 12th, was, as usual, exceedingly well attended. "It was strictly informal, the programme ranging from the telling of stories to a wrestling match." The members were asked to note that the date of the annual dinner, which was to have taken place on March 8th, is unavoidably altered to March 15th, owing to the proximity of the former date to the annual general meeting, which takes place on March 3rd.

Educational Notes.—On Saturday (15th inst.), the Clyde Model Engineering and Electrical Institute was opened in Govan, Glasgow; it has been established for the purpose of enabling apprentice engineers and other young mechanics to study their trades and develop ideas by experimenting with models. A well-equipped workshop has been provided, and already about 200 members have been enrolled.

The Education Committee of the London County Council has issued a report on eight years of technical education and continuation schools—mainly evening work.

New British Westinghouse Club.—On Saturday last the British Westinghouse new club premises in Moss Road, were formally opened. The Club is now open to all male employés of the British Westinghouse Electric and Manufacturing Co. The building has been constructed with a view mainly to convenience, and consists, on the ground floor, of a large hall capable of seating 300 persons, a dining room, and a spacious billiard room containing two tables. The remainder of this floor is occupied by the stewards' living rooms, &c. Upstairs are a number of committee and retiring rooms. The basement is mainly devoted to the rifle range, for which a sound-proof room has been constructed, giving a range of 25 yards and accommodation for four people to shoot at once. As regards the outdoor section, there will be five tennis courts, three grass and two hard, and a bowling green, and although these are not yet quite complete, it is expected that they will be in good working order by the commencement of the season. Mr. Peck, chairman of the Committee, opened proceedings by voicing the satisfaction of all present that the time had come when the difficulties of inception and organisation had been overcome, and the proud moment of inauguration had arrived. This had been made possible by the financial support of the directors and the members of the staff, but was mainly due to Mr. Lange, managing director, for his support throughout.

Mr. Longworth, the architect, presented a golden key to Mr. Lange, and Mr. Lange, in accepting, expressed his thanks. He said that it was his opinion that a turning-point in the history of the Club and the British Westinghouse Co. had been reached, and this had only been possible on account of the hearty co-operation of the staff. It was his pleasant duty to declare the Club open, and in doing so he outlined the history of the organisation. The forerunner of the present club had been primarily devoted to the the engineering side of the firm and had been inaugurated as a means of transmitting to the younger employés, the apprentices in particular, the knowledge possessed by the older engineers, and he wished to emphasise the fact that that object should always be kept in mind, and he appealed to the older members to foster the spirit of co-operation and watch over the well-being of the younger members. He wished to express his appreciation of the various interests now gathered under the one name, the British Westinghouse Club, such as the Social and Improvement Society, the Foreman's Association, and Apprentices' Section, who had so loyally subordinated their individual interests to the well-being of the Club as a whole. He referred to the great interest that Mr. Carlton, a previous managing director of the company, had in the Club and to the strongly educational lines on which he considered that it should be run, and that although the management of the company had modified this view somewhat, it was hoped that that primary object would always be kept in view. Mr. Lange also made special reference to the invaluable work of Mr. Tearle and his friends. In conclusion, he wished the club all possible success.

Mr. Tearle, chairman of the House Committee, regretted that the club was not in a more advanced state of completion, but said that it had been the feeling of the committee that in view of the large membership, it was advisable to open the premises at the earliest possible moment. It was some considerable time since Mr. Peck and Mr. Bissett conceived the idea and sketched out rough plans. The club was indebted to Mr. Derwent Simpson, solicitor to the company, for his help in suggesting methods of raising the necessary funds. On his recommendation, it was decided to issue

New British Westinghouse Club.

debentures to the extent of £3,000, of which £1,500 had been taken up by the company, who had also cancelled an existing debenture of £675, the interest on which was being paid by the club. The rest of the debentures have been taken up by members of the staff with the exception of about £150. He wished particularly to refer to the great kindness of Mr. Lange, not only in the gift of the three tennis courts, which would be a permanent record of such kindness, but for his advice and enthusiasm throughout.

Sir W. H. Bailey offered his congratulations, and mentioned that as a director of the Trafford Park estates, he was one of the first to discuss with Mr. George Westinghouse the question of purchasing a plot of land in Trafford Park for the company.

The remainder of the evening was devoted to the social side, and an enjoyable entertainment was given by the "Limits." An opportunity for the inspection of the premises was also afforded.

Possibilities of a Tidal Electricity Works.—Plans for utilising the tidal motion of the sea have often been suggested, without coming to anything. However, the first serious attempt to use it for the production of energy will shortly be made at Husum, on the Schleswig-Holstein coast of the North Sea, where, between the Isle of Nordstrand and the mainland, a reservoir of 4,000 acres is to be created by means of embankments. This reservoir will be subdivided by another embankment into an upper and a lower tank, communicating by sluices with the shallow inland sea on one hand and the turbine plant on the other.

The scheme is based on the assumption of a uniform tidal amplitude of 3 metres, the lowest ebb and highest flood each time reaching the same level, and their difference of level always being 3 metres. Under this assumption the working of the plant will be as follows:—When the water in the sea is higher than in the upper reservoir, this will be filled through the sluices; if, on the other hand, the water in the upper reservoir be at a higher level, this will flow off through the turbines, thus actuating the latter. This would commence some time after the beginning of low tide, and cease shortly after the beginning of high tide. An opposite process is to take place in the lower tank; when the water in the sea is higher than in the tank, it will flow in through the turbines, thus starting these some time after the beginning of high tide, and stopping them some time after the beginning of low tide. If the water in the sea be lower than in the tank, water will flow from the latter through the sluices into the sea.

The promoters of this scheme, on the hypothesis of a regular return of tidal amplitudes, presume that the operation of the turbines from one of the tanks may begin at the very moment the operation from the other tank ceases, thus ensuring a continuous service; they are reckoning on a level difference of 1½ to 2 metres between the sea and the tank actually in operation, the water in both tanks rising and falling about 1 metre during each tide.

The turbines are to yield 5,000 H.P., driving dynamos which will work without any accumulators, thus communicating their output directly to the supply system. The cost of construction is estimated at 5,000,000 marks, of which about 3,500,000 marks is allowed for the embankments and about 500,000 marks each for the turbines

and sluices, the buildings and the electrical part of the plant. The cost of the KW.-hour as produced in the tidal electricity works has been calculated in the first instance at 1½d., but in the event of a large consumption it will be reduced considerably (down to ½d. and less). Even should the electrical enterprise fail, the promoters would in any case recover the value of the land reclaimed from the sea.

In an article recently published in a German daily paper (*Hamburger Korrespondent*), Mr. L. Benjamin severely criticises this scheme. He draws attention to the fact that the levels reached by the high and low tides are subject to considerable fluctuations, often unexpected and abrupt. When calculations are based on the actual tide curves, the hypothesis of an immediate transition between the working periods of the two tanks is seen to be inadmissible. In the most favourable case the dynamos would work during a period of about four hours, followed by a standstill of two hours, after which the next working period would begin. The working periods of four hours each would, according to the beginning of high tide, occur at changing times of day or night, so that the energy produced by the turbines, far from being always utilised immediately, would have to be stored, to be distributed to consumers at the right moment. No regular operation would thus be possible without the aid of expensive accumulators. Moreover, the district to be supplied would be by no means suitable for a rural power transmission plant, the enormous length of conductors and numerous transformer stations increasing the cost of electrical energy at the place of consumption far beyond the figure at which it could be produced by properly-designed steam electricity works.

The figures allowed for the cost of the reservoir are likewise criticised. As the ground at present lies at 1½ to 2 metres above normal low level, the formation of two tanks of so enormous a size would entail the excavation of at least 25,000,000 cb. metres of soil, which, if feasible at all, would greatly increase the estimated cost. The embankments, about 12 km. in length, would likewise entail an enormous expenditure on account of the muddy ground they would have to be built on.

In planning the machinery, the effective head has simply been taken as identical with the level difference between the sea and each tank. However, the water, in order to get from the remoter parts of the reservoir to the turbines, requires a sufficient head, while the water discharged from the turbines necessitates some additional head to avoid any back-pressure. When these heads are deducted from the level difference, the head actually available for the turbines is reduced considerably, beginning at most with 1 metre and falling to zero in the course of a working period. Now, while there are no turbines working under heads approximating zero, turbines suitable for a head of 1 metre are necessarily unsuitable for use with heads of less than ½ metre. In order to make up for this defect the number of turbines would have to be multiplied.

As, finally, the foundations of the turbine plant on the muddy soil of the s a coast would be extremely costly, the installation of the contemplated tidal electricity works would seem to entail a prohibitive expenditure, while its chances of success would be anything but satisfactory.

Annual Socials, &c.—Blackpool.—Employés of the Blackpool Corporation Electricity and Tramways Department held a successful whist drive and dance on February 12th. The effort was in aid of an institute which the employés propose to organise for recreative purposes. Mr. C. I. Baker, the tramways traffic superintendent, was M.C. Alderman J. Brodie, J.P., chairman of the Tramways and Electricity Committee, assured the men that the Committee would do its best to assist them with their proposed institute. The Mayor rejoiced that the feeling of union amongst the tramway employés was so thorough. Mr. C. Furness, the general manager, said this was the first united whist drive the Electricity and Tramways Department had organised. When they considered that the two departments consisted of some 500 men, and most of them had families, he thought the time was opportune when they should have an institute of their own in which they could have social gatherings.

London.—Some 60 members of the staff of Electrical Installations, Ltd., held their sixth annual dinner at "The Horns," Kennington, on the 15th inst., Mr. Stanley C. Russ being in the chair, who, after the usual toasts had been drunk, in a short speech alluded to the satisfactory growth of the business of the company. Advantage was taken of this opportunity to enroll a large number of new members for the E.I., Ltd., Athletic Club. After the dinner, various members of the staff entertained the company with a variety programme.

Manchester.—On Friday last, February 14th, at the Midland Hotel, Manchester, 200 members of the staff of Ferranti, Ltd., held their annual dinner, which was followed by a musical entertainment, to which some of their number contributed.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At a meeting of the Scottish Local Section in Edinburgh, last week, Mr. W. B. Hird, Glasgow, read a paper on the "Electric Arc," an electrically propelled vessel, which was built and put on the Clyde in 1911, for the purpose of demonstrating a particular method of electric propulsion.

Junior Institution of Engineers.—The twenty-ninth annual dinner of the Institution was held on Saturday last at the Hotel Cecil, Sir A. Trevor Dawson, the President, occupying the chair.

After the loyal toasts, Rear-Admiral Arthur W. Waymouth (Director of Naval Equipment in the Admiralty) gave that of the "Profession of Engineering," which he claimed to be the most important in the world, because its purpose was the adaptation of the forces of nature to the service of man. Since the old days of the hansom cab and the sailing ship, steam and the internal combustion engine had brought about wonders. The latter especially had made flight in air and submarine work possible, and would probably lead in the future as a motive power in engineering works. In naval construction, so extensive was the use of machinery in battleships to-day that every Naval officer was an engineer, and was proud to be one. In conclusion, the speaker recalled his close association with Sir Benjamin Baker on the Board of Ordnance, and paid a tribute to the value of the work accomplished by that great engineer. Capt. H. Riall Sankey, in reply, said that engineering was the only profession we could not do without. It was cosmopolitan and knew no bounds. He referred to the "Socialism of intellect" shown by Sir A. Trevor Dawson in his presidential address, in proposing that likely lads should be taken up and educated by the State.

The toast of the "Junior Institution of Engineers" was submitted by Major E. H. Hills (President of the Royal Astronomical Society) who, as a representative of one of the oldest scientific societies, extended the hand of fellowship to one of the youngest. To the astronomer, the work of the engineer in the mounting of telescopes, and in other ways, was vital and important. The differences between them were great, the work of one being speculative and that of the other practical. The engineer's sphere was "to do things," that of the astronomer "to know things," and those who would criticize the latter must remember that the useless things of one generation became the practical things of the next. The researches of Clerk Maxwell in one generation gave to the succeeding one wireless telegraphy, and enabled the wealthy merchant on the *Mauretania* to be kept daily in touch with—the price of lard. The desire to know things marked off the Western mind from the Oriental and the savage mind and placed it in the forefront of civilisation. As an instance of this desire for knowledge, the speaker referred to the life of Dr. Wilson, the naturalist to the Scott expedition, "whose loss had thrown a nation, and indeed the whole world, into mourning." One of the problems Dr. Wilson set himself to solve was that of the nesting and embryology of the emperor penguin, a bird which laid its eggs on ice in the middle of winter. Two years ago the doctor and two companions set out on a five days' journey, and on arrival at the desired locality, made a snow hut, but hardly was it finished before a fierce blizzard blew the roof away, together with their tent and other belongings. For 48 hours they lay in their sleeping bags without food. When the storm ceased, a consideration of the direction of the wind enabled them to recover their tent, and they were successful also in finding the eggs, for the possession of which they had risked so much. Curiosity was one of the highest characteristics of our race, and without it we were poor creatures of no value. We had still some chance of salvation if we did not commit the unpardonable sin of a blind worship of the useful.

Mr. S. Bylander (chairman of the Institution), in response, spoke of their hope of being able to secure a building of their own in the near future, and of the several advantages of membership. Their motto was "no standing still."

Later, Mr. W. A. Tookey (vice-chairman of the Institution) in giving the toast of "The President," referred to the services Sir A. Trevor Dawson had rendered them, and particularly to the value of the first Canet lecture, which he delivered four years ago, on "The Engineering of Ordnance."

An excellent musical programme was provided and was greatly enjoyed by all present.

The Concrete Institute.—A paper was read by Mr. S. Bylander, entitled "Steel Frame Buildings in London," at the meeting on February 13th. The next meeting of the Institute will take place on February 27th, when Mr. J. A. Davenport will read a paper entitled "Economy in Reinforced Concrete Design."

The Institution of Electrical Engineers (Students' Section).—Mr. D. Betts (vice-chairman) has been transferred to the class of Associate Members, and his office is now filled by Mr. G. W. P. Page, who vacates the hon. secretaryship. The newly-elected hon. secretary is Mr. E. T. Driver, 24, Bradgate Road, Catford, S.E. The discussion on Mr. Page's paper has been adjourned to February 26th.

Manchester University Engineering Society.—At a meeting of the Society on February 12th, Mr. S. L. Pearce, chief electrical engineer to the Manchester Corporation, gave a lecture on the Manchester electricity undertaking, illustrated with maps and lantern slides.

Institution of Mechanical Engineers.—The annual report of the Council was presented to the members at the meeting on Friday last week. It shows that the total membership at December 31st, 1912, was 6,160, an increase of 332. The total revenue for the year was £16,950 and the expenditure £13,344, leaving a surplus of £3,606, of which £710 was carried to capital account as entrance fees and life compositions. The net capital of the Institution amounts to £64,237. In an appendix to the report, full particulars are given of the scheme of examinations for Graduateship and Associate Membership as adopted by the Council. The next summer meeting will be held in Cambridge at the end of July.

The Association of Engineers-in-Charge.—A most enjoyable social evening and dance was held in connection with the above Association on Saturday, February 8th, when a company of upwards of 200 members and friends were present in the St. Bride's Institute, E.C. There was a good selection of dances with five extras, including a flirtation and card dance, and Mr. Hardy's Bijou Orchestra, which was engaged for the occasion, provided an excellent musical programme. The special dances created much amusement, and at the same time added materially to the sociability of the evening. Messrs. H. E. Neal and W. T. Pickett (chairman and vice-chairman of the Association respectively) supported the efforts

of the committee by attending the function, and the arrangements made for the entertainment of those present left nothing to be desired. Messrs. W. H. Ball and M. C. White acted as M.C.'s for the evening, and they carried out their duties in a very effective manner.

Association of Mining Electrical Engineers.—Mr. A. B. Muirhead recently lectured at Musselburgh, on the subject of "The Handling of Electric Plant in Collieries," before the Eastern Branch of the Association.

An examination for competency in mining electrical engineering will be held on March 8th and 15th, at 10 centres in the United Kingdom. The subjects are A.C. and D.C. theory and practice, the special rules, distribution of electrical energy, electric lighting and signalling, &c. Full particulars can be obtained from the general secretary of the Association, C. St. C. Saunders, Bank Chambers, London Road, Derby, or any of the branch secretaries. Candidates must be on the register of the Association.

The Council announces that the following prizes are offered for papers for the present session:—An Association prize of Five Guineas for the best paper read at any branch; a prize of Two Guineas, given by Mr. Carlow, for the best paper by a member of the East of Scotland Branch; a prize of Four Guineas, given by Mr. Alex. Anderson and Mr. Matthew Brown, for the best paper by a working colliery electrician who is a member of the West of Scotland Branch; and a premium of Two Guineas, given by Lord Joicey, for the best paper by a member of the North of England Branch. Further particulars can be obtained from the General Secretary of the Association, Bank Chambers, Derby, or any of the branch secretaries.

The Electro-Harmonic Society.—The next concert (ladies' night) will be held at the Holborn Restaurant (King's Hall) on Tuesday, February 25th, at 8 o'clock p.m. The artistes are as under:—Vocalists: Miss May Huxley (soprano), Miss Violet Oppenshaw (contralto), Mr. Hubert Eisdell (tenor), and Mr. Ivor Foster (baritone); violoncello, Mr. W. H. Squire; recitations, Miss Elsie Fogerty; entertainer at the piano, Miss Haidee Hamilton; entertainer, Mr. Thornley Dodge; solo pianoforte and accompanist, Mr. Bernard Flanders, A.R.A.M.

Fatality.—The death took place on Sunday at the Bolton Infirmary, of Albert Blakely (22), of Everett Street, Bolton, a tramcar conductor in the employ of the Corporation. On the previous day, whilst in charge of a car in Bradshawgate, Blakely, by some means, was struck by a passing tramcar, sustaining injuries which proved fatal.

Coal Stacking and Firing.—A paper by Mr. Kendrick was recently read before the Manchester District Institution of Gas Engineers. He endeavoured to explain the fires that had happened to stacks of coal during some months. At his works at Stretford they have had three serious fires in four years, and many cases of overheating. No. 1 store held 1,800 tons, and was an old retort house partly roofed, with and partly without louvres. No. 2 store holds 1,400 tons and has no louvre. No. 3 holds 800 tons, and has a two-span roof of corrugated iron. In the first two, coal is delivered by conveyors. In No. 3 it is hand-stacked, 14 ft. high. In the other stores it is piled in pyramids 24 and 20 ft. high, the top of the cones being 8 ft. across. No. 1 shed had given most trouble. The finest slack is usually sent direct to the retorts, but much fine stuff still gets into the store and fills the middle part of the piles, and to this dust and small coal the fire trouble is due.

As a result of what was observed, after each boat had been discharged, the fine dust was dug out and spread over the heap, and pipes were put in at intervals to enable the interior of the pile to be watched. Three years of immunity led to laxity, and the small stuff had not been fully dug out, and a fourth fire occurred. It was again the small coal which heated, but was not the immediate cause. Some old screened coal was buried under the new coal, and the store was filled, in about six weeks, to its utmost capacity. On emptying the shed, the rough coal under the slack was quite carbonised and fire was creeping under the slack. Apparently air had reached the new coal through the old tongue of open rough coal. The temperature in the tubes rose slowly to 90°, then quickly to 110°, with a quick jump to 300°, and it required a week to reach the fire, which had then spread considerably. As this coal was stored in the hot month of May, 1912, and was stacked quickly and was dustier than usual, these causes appear to have been active in producing fires.

The colliery agents attribute the numerous fires of that year to the fact that after the strike, coal was much crushed at the face, and was very small, and it was not clean, being hurried away quickly for use, and more probably fresher coal than usual was stacked. Freshly-wrought coal is more prone to heat, especially if fine.

Coal as received is warmer than the atmosphere, as much as 2° to 12° in summer, and 4° to 20° in winter. Since a pit may have a temperature of 90°, coal must start from the pit fairly warm, and if stacked too soon, too high, or in too large mass, it is prone to heat. Also, coal mined first after the strike would be damper than usual, and dampness seems to engender fire.

Coals absorb from one to three times their volume of oxygen, and this produces heat, and if it can occur in a thick mass the heat accumulates. Stacking in cone shape from a conveyor causes the fines to accumulate at the apex, and these are apt to fire. This system of storage is thus to be regarded with suspicion. Coal owners suggest 11 to 15 ft. as the height of coal stacks, or a mean of 13 ft. Gas-works practice is to stack 10 to 30 ft. Since coal under cover cools less slowly, it should be stored in less depths than when out of doors, whereas the reverse is the usual practice. The question of ventilation is a disputed one. Some men say ventilate freely and carry off the heat. Others say keep out all air and no heat can be generated. If this is so it would be quite safe to store in closed bunkers, exhausting the air at the top and admitting CO_2 at the base to fill the voids between the coal. In practice it appears that coal will be reached by air enough to make it become hot. Therefore, supply ample air to carry off the heat, for the oxidation will be less if the coal is cold. Yet in mines ample ventilation to remove gas has caused heating in the gob, and the checking of the air current has stopped the heating.

If a heap fires, very much water is needed to quench it, for water sets up air currents to fan the fires. At Stretford they treat affected coal with strong ammoniacal liquor and only put water on unaffected coal. The summing up is that coal from different seams should not be mixed, nor should coal of different classes.

Fine slacks should not be stacked at all, nor damp coal under cover. Large heaps are the more dangerous. Lumps, nuts and fines should be well mixed in stacking. Limit heights to 20 ft. in the open, and 16 ft. under cover. Avoid external sources of heat, leaking roofs, &c. Keep temperature records of coal as received and in stock, and if the heat rises to 90° or 100°, remove the top layers and watch carefully. Do not disturb a fired heap by pushing in bars. Do not apply water to a fire, but ammoniacal liquor. Remove and use heated coal promptly.

From remarks made during the discussion, it would seem that if coal is screened and stacked it does not become hot. This indicates the smalls as the cause of trouble. But it also indicates the need for good air circulation, for it is the fines that prevent this. It seems impracticable, as a rule, to gain safety by excluding all air, as that would undoubtedly prevent fire, for to produce fire there must be oxygen. The question is, can coal absorb oxygen, as oxygen which shall only begin to work when the coal is stacked? With present, day large stacks of coal, the subject becomes important.

Mr. C. S. Northcote's Bankruptcy.—Charles Spencer Northcote, 67, Stanthorpe Road, Streatham, London, electrical engineer.—The receiving order herein was made on creditors' petition, the act of bankruptcy being the failure of the debtor to comply with the requirements of a bankruptcy notice duly served upon him. The debtor appealed from the receiving order, and an order was made staying all proceedings thereunder pending the hearing of the appeal, which had now been dismissed. According to the statement of affairs, the liabilities are expected to rank at £1,709 12s. 10d. and the assets are estimated to produce £33 6s. 6d. The debtor became London manager to a firm of electrical engineers, and the firm having become a limited company in 1903, he was appointed a director. Three years later he left the company and sold his shares therein for about £4,000, opening an office at 2, Queen Anne's Gate, Westminster, on his own account. He traded there under the style of the Wholesale Electric Traders, and, at the same time, he was honorary secretary to an association, in which capacity he organised and managed the Manchester Electrical Exhibition of 1908. In 1909 he gave up his offices, and has since had no office and earned practically nothing, although he has tried to develop various electrical schemes, and he has lived on his capital. He purchased a freehold house at Forest Hill some 10 years ago for £3,000, and spent £1,000 on improvements. He had an overdraft at the bank, but gave them a fixed mortgage on the house for £1,500 about two years ago. He left this house in April, 1912, and it was unoccupied until last November, when the mortgagees sold it by auction for less than the mortgage money. When he left this house he instructed the petitioning creditors to sell by auction the bulk of his furniture, and they did so; but being dissatisfied with the way in which the sale was conducted, he consulted a solicitor with a view to bringing proceedings against them. The petitioning creditors alleged that certain letters written by the solicitor so instructed were libellous, and they thereupon commenced proceedings against the debtor for libel, the action coming on for trial at the end of last June, when judgment was given by default, and the case referred to the Sheriff to assess the damages. Debtor instructed other solicitors, who appeared at the Sheriff's Court, but a verdict was given against him for £400, and costs. An appeal, which was entered by the debtor, was dismissed, and the petitioning creditors thereupon brought the present proceedings. No books of accounts had been kept by the debtor, who ascribed his failure to the verdict obtained against him by the petitioning creditors for damages for an alleged libel and the costs of the action.

At the first meeting of creditors, held last Tuesday at 132, York Road, Westminster Bridge Road, S.E., it was decided to leave the matter in the hands of the Official Receiver.

Appointments Vacant.—Charge engineer, for the Corporation Electricity Works, Crewe (£80). Chief draughtsman, for Provincial Cinematograph Theatres, Ltd. (£182). Electrical fitters, for H.M. Dockyard, Portsmouth (36s.). Fitter-driver for the Severalls Asylum, Colchester (35s.). See our advertisement pages in this issue.

A South London Exhibition.—This week, at Raleigh Hall, Effra Road (opposite Lambeth Town Hall), the South London Electric Supply Corporation, Ltd., is running an exhibition of electric heating and cooking. Demonstrations are given daily at 3.30 and 7.30 p.m. To-morrow (Saturday) night the Exhibition will close.

SELF-STARTING SYNCHRONOUS MOTORS.

The Lancashire Dynamo and Motor Co. has recently constructed a number of self-starting synchronous motors, some particulars of which we are enabled to publish herewith.

The "Lancashire" self-starting synchronous motor has been designed to overcome the great drawback of the synchronous machine, viz., that it requires skilled attention and synchronising before it can be put on the circuit. The "Lancashire" type of machine starts up like a wound-rotor induction motor, and when it is up to speed, and the exciting current is switched on, it pulls itself into step automatically, thus enabling the motor to be used for all sorts of industrial purposes where a synchronous motor of the ordinary type would be inadmissible.

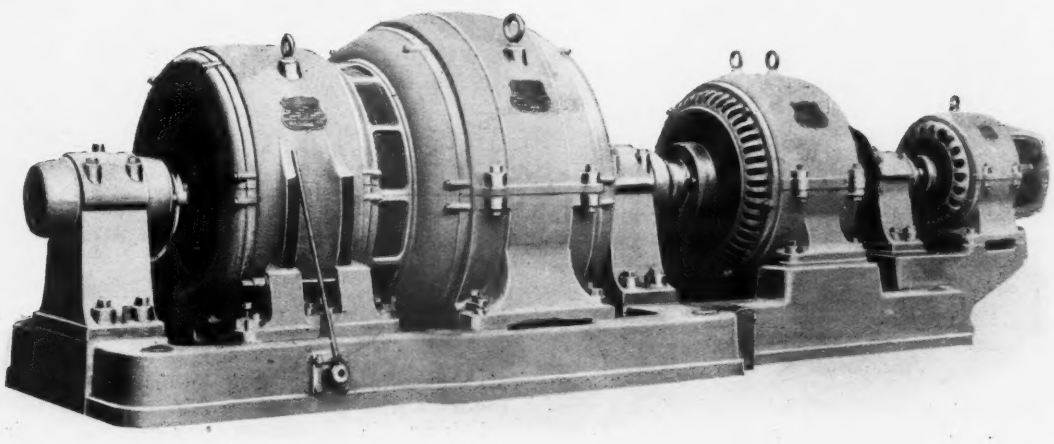


Fig. 1.—750-h.p. Self-Starting Synchronous Motor driving Tramway Generator, Alternator and Exciter.

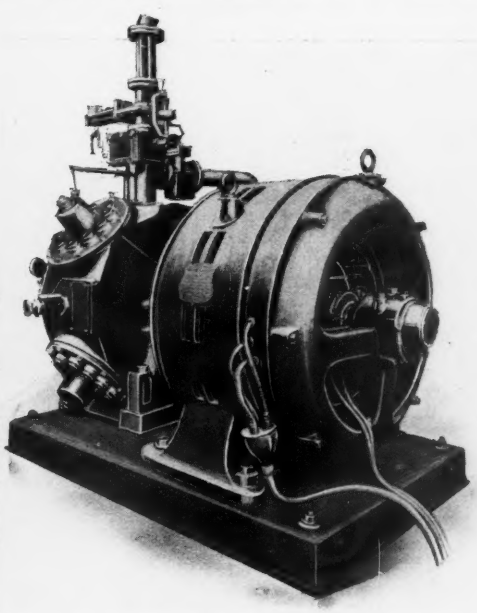


Fig. 2.—Motor-driven Air Compressor for London, Ont.

The current is switched on to the stator by the stator switch, and a resistance is put across the slip rings in parallel with the field winding. The motor then starts up, and as the resistance is cut out the speed rises until it gets close to synchronism. At this point, the rotor is put across a buffer resistance, and the switch being moved one step further puts the exciter across the slip rings, with all the resistance in series with the field.

The motor then comes into synchronism and runs as a synchronous motor, the field excitation being adjusted to suit the power factor which is required.

This type of motor is specially suitable for installing in a works and driving machines such as pumps or air compressors, on which the load is fairly constant. The excitation can be adjusted to raise the power factor of the works to something in the neighbourhood of ·9, which is about the most economical value.

The motors are of the revolving field type with cylindrical rotors; the stator windings are former-wound, embedded in partially-closed or open slots, and insulated in micanite troughs, which project some distance from the core and provide against breakdown at the point where the windings leave the slots. The end connections also are clamped to the end plates when necessary.

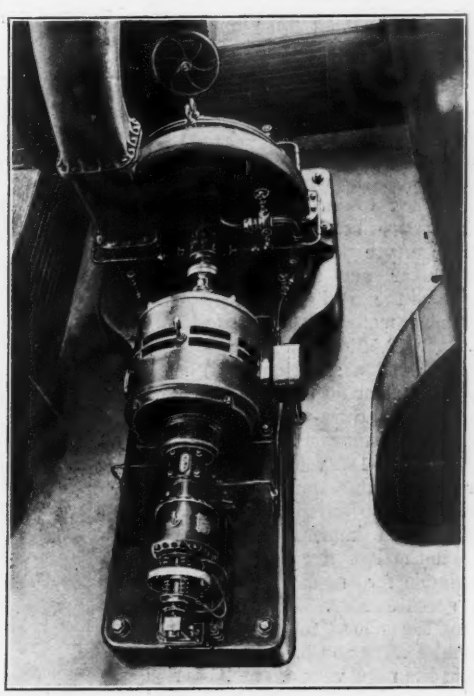


Fig. 3.—Rateau Turbo-Blower with 250-h.p. Synchronous Motor Drive.

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The rotor is constructed with numerous ventilating ducts, and a fan of full rotor diameter is provided on either side of it, which, in conjunction with the stator end shields, provides an excellent ventilating arrangement, the constructive features of which are shown in the views of the Erindale frequency changer mentioned later.

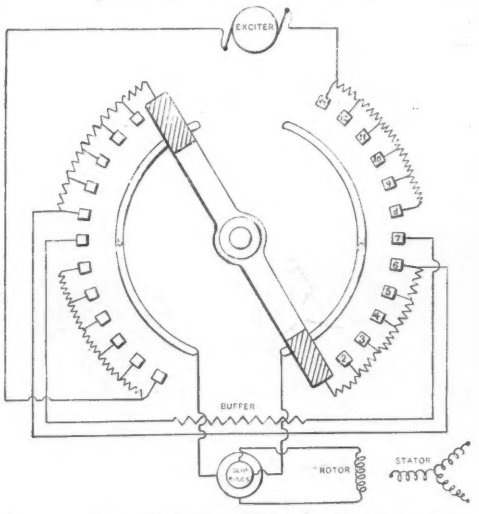


Fig. 4.—Starter Connections for Self-starting Synchronous Motor.

The rotor coils are wound with flat copper strip and afterwards taped. Standard ball bearings are fitted to the journals, and a double ball thrust bearing is provided to keep the rotor in position, the other bearings being free. These motors have been used for a variety of driving purposes, and some of these we illustrate; they have also been supplied to run idle and act as rotary condensers.

Our first view shows a 750-H P. combination, one of two similar sets supplied to the city of Guelph, Canada, each consisting of a 750-H.P. self-starting synchronous motor direct-coupled to a D.C. traction generator and alternator with exciter; the latter machine is used to change the periodicity of supply from 25 to 62½ cycles, and the set runs at 750 R.P.M. from the 2,200-volt three-phase mains; the other views of similar motors in use are self-explanatory.

We further illustrate in figs. 6 to 9 a frequency changer recently supplied to the Erindale Power Co., Canada. The set consists of a synchronous motor direct coupled to an alternator, supported on two beam bed plates with three bridge type pedestal bearings, the starter motor and the exciter being carried by the end pedestals. The synchronous motor capacity is 1,150 K.V.A. at 12,500 volts, three-phase, 25 periods, and a speed of 300 R.P.M., and the alternator develops 1,000 K.V.A. at 13,200 volts, three-phase, 60 periods. The exciter is shunt wound, and generates 320 amperes at 125 volts. The starter motor is of the wound rotor type, running off 2,200 volts, and is controlled by a special oil immersed rotor starter in which the last five or six contacts are suitable for regulating the speed when synchronising. Fig. 6 gives a view of the above set taken on the Lancashire Dynamo Co.'s test bed.

From the rotor view of the 25-period machine, it will be seen that the field system is built up with salient poles, which are bolted to the periphery of the plate type cast-steel flywheel. The poles are built up of mild steel stampings, in order to reduce the eddy current losses to a minimum. The construction of the field system facilitates the removal of the poles when this is desired for inspection or repairs.

The field coils are wound with copper strip on edge; this arrangement prevents the layers rolling under centrifugal force. Each coil is insulated and securely bolted between the spigots of two bronze clamping plates; afterwards it is placed on the pole and fixed against the pole tip by means of set screws. The pole tip prevents the coil flying out under the action of centrifugal force.

The machines are fitted with a system of forced ventilation to ensure cool running, fans being fixed on either side of the field system, as shown in our view of the rotor. The cold air is drawn in and forced by the fans against the stator end-connections and along the field coils. The stator end-shields provide an effective guide to direct the air to the desired portions of the machine, and the hot air is expelled through holes in the stator case.

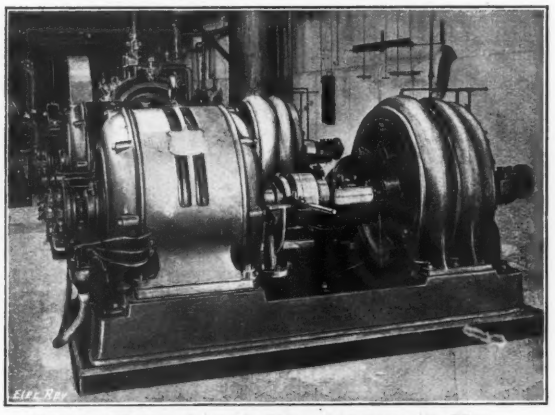


Fig. 5.—200-H.P. Self-starting Synchronous Motors Driving Pumps.

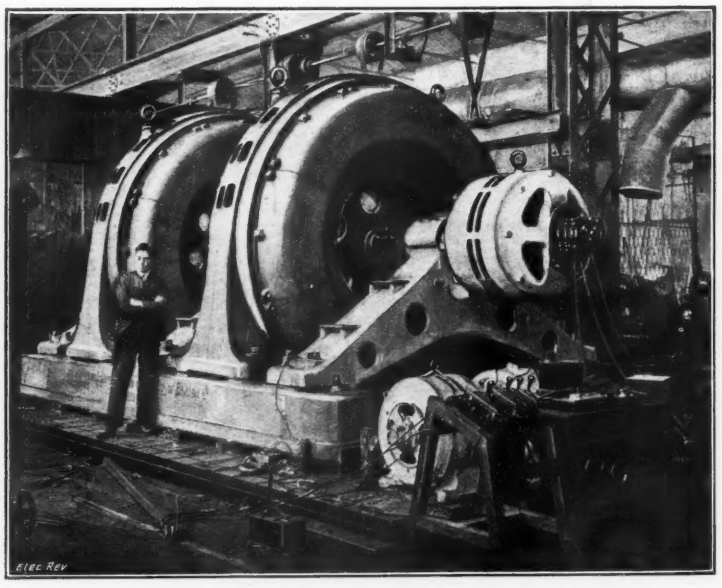


Fig. 6.—1,000-K.V.A. Frequency Changer by the Lancashire Dynamo & Motor Co.

ELECTRICAL APPARATUS AND STANDARDISATION.

By W. A. TOPPIN.

A certain amount of standardisation is necessary in every industry. There are two ways by means of which it may be brought about. One is for the manufacturer to obtain the monopoly of manufacture of any particular article, as has been the case in the wood-screw industry; the other and much more satisfactory way, is for a committee of experts to issue rules that all the manufacturers agree to abide by. Fortunately for the growth of electric lighting, lamp caps have been standardised. Now that the public are beginning to find out that electricity can be used for so many purposes

besides lighting, wall plugs and a number of other things should be made of one stardard pattern, so as to make electricity as cheap and as easy to use as possible.

I propose in this article to deal only with such electrical accessories as may be found in any house or office. If the Cable Manufacturers' Association could only arrange some means whereby anyone could at once say that a particular wire was association or non-association grade, it would save

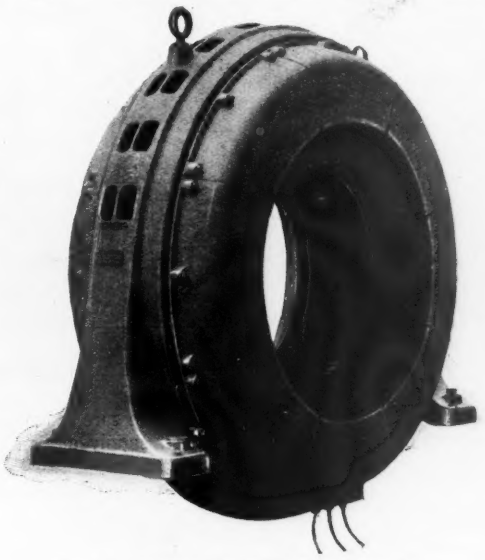


Fig. 7.—Stator, Showing End Shields.

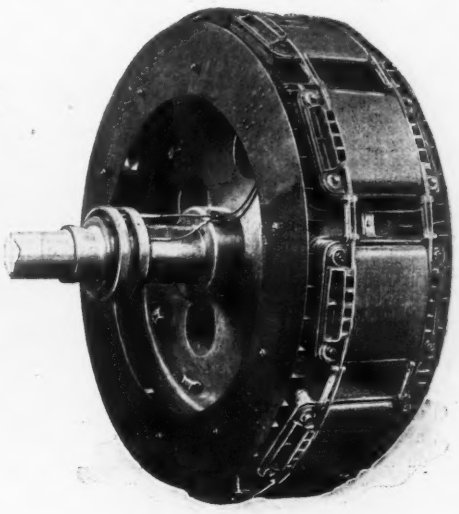


Fig. 8.—25-Period Rotor, Showing Ventilating Fans.

Frequency Changer for the Erindale Power Co. (see page 306).

the poorer contractors from taking such care of the labels from coils of association grade wire so as to make them last out a few coils of the other grade.

The screw thread for tubing should be standardised. At present contractors are put to considerable trouble through a tube from one maker not screwing into a T box bought somewhere else.

The number of types of main switches is legion, but this is not of such moment as the fuse question. Main and sub-fuses have to be frequently replaced, and it is essential that any non-electrical man should be able to do this, and make a good job of it with no risk to himself. For this reason I am a strong advocate of the spring clip type of fuse. The wire is visible, it can be replaced without fear of shock in the minimum of time. Now these clips vary; buy six fuse-boards from six different makers and specify the same voltage and current in each case, and the chances are that not one of these clips will be interchangeable. What is the result? A consumer A breaks a clip and goes to a contractor B for a new one, who finds he does not stock this particular pattern. A goes back, ties a piece of lemonade wire round the fuse terminals, and after one or two more fuse clips break tells B to fix a new fuseboard.

The distance apart and the width of the fuse clip contact should be settled for certain definite pressures.

An example of lack of uniformity between four five-ampere 250-volt porcelain clip fuses: the distances between fuse terminals were $2\frac{1}{32}$ in., $2\frac{3}{32}$ in., $2\frac{3}{32}\frac{7}{2}$ in., and $2\frac{3}{32}\frac{1}{2}$ in., and the thicknesses of the contact clip varied from $\frac{1}{16}$ in. to $\frac{3}{8}$ in.

A large firm are specialising in fuses of the screw-in Edison plug type. If these become popular other firms must be prevented, if possible, from making similar fuses having different screw threads. Switches do not give much cause for complaint, but wall plugs are most urgently in need of standardisation.

An example of the differences found between three five-amp. plugs by different makers: the distances between the centres of the contact pins were $\frac{7}{16}$ in., $\frac{3}{4}$ in., and $\frac{5}{8}$ in., and the diameters of the pins also varied. The use of wall plugs for irons, kettles, radiators and the like is increasing so rapidly that the lack of uniformity becomes very important.

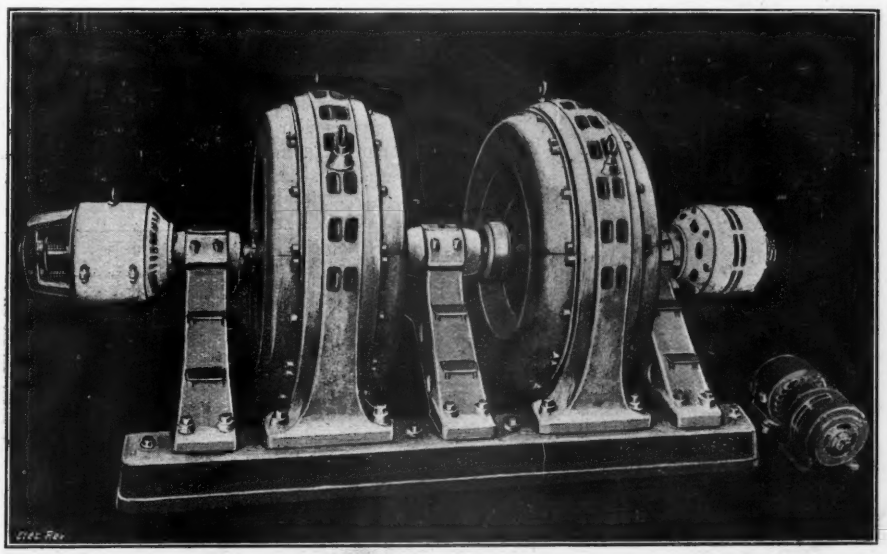


Fig. 9.—Frequency Changer Supplied to the Erindale Power Co., Canada (see page 306).

Although the Edison type of screw lamp is not much used in this country except for battery work, the diameter and screw threads should be fixed. Attention was called to radiator lamps and their attachment by a prominent central station engineer a few weeks ago. He advocated a special holder. Certainly the ordinary bayonet socket type suitable for a 50-c.p. Osram lamp is not suitable for carrying 1 ampere continuously. A screw-in connection similar to a "Zed" fuse seems very suitable, and should be standardised.

The connecting pins for electric kettles, irons, heaters, &c., all vary. An iron bought one year from a very prominent firm has a totally different sized connecting pin from

an iron of the same size made two years later. A customer has therefore to state when ordering a new connector in what year his iron was made.

The time has undoubtedly now come when the electrical industry can standardise without anything but good resulting.

THE NEW WORKS OF MESSRS. ECKSTEIN, HEAP & CO., LTD.

Recently, through the courtesy of Messrs. Eckstein, Heap, we were enabled to inspect the new premises, known as the Lancashire Switchgear Works, in Caroline Street, Broughton, Manchester, into which they have moved, with a view to providing for a considerable extension of their business. It may be remembered that the concern was recently turned into a limited company, with Mr. Eckstein as managing director.

The new premises consist of three spacious floors, subdivided into various departments adapted for the firm's switch, fuse and instrument business.

The ground floor contains a machine shop fully equipped with capstan and other lathes, milling, grinding, drilling machines, &c., and adjacent to it an erecting shop for switchboards and mining switchgear, the latter being a recognised speciality with the firm.

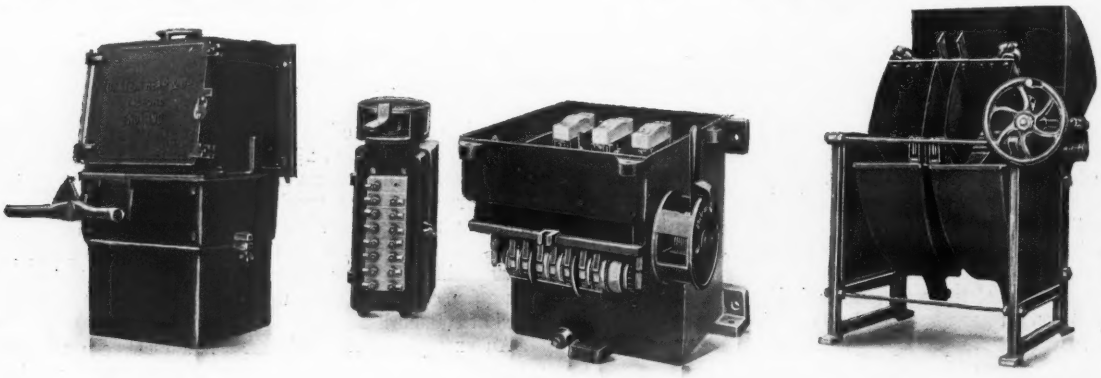
A section of the ground floor is reserved for the packing department, and on each floor suitable stores are provided for the particular class of work carried on there.

The test room equipment includes motor-generators and transformers for giving up to 40,000 volts pressure and several thousand amperes, but heavy material is tested in the shops by means of portable equipments on trolleys, which

The Drawing Office, Messrs. Eckstein, Heap's New Works.

will give the necessary current and pressure range desired, and can be plugged into the local supply at convenient points.

Amongst our views are some of typical productions turned

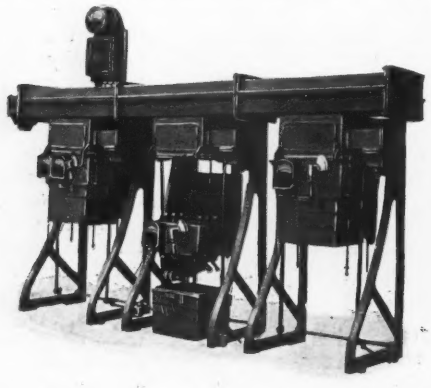


Auto-transformer Motor Starter. Controller for Auto-starter. Auto-transformer Starter with fuses. Liquid Starter.

Some Eckstein, Heap Specialities.

The feature of the first floor is the extensive accommodation provided for the drawing office and estimating staffs, the counting house, board room and various private offices.

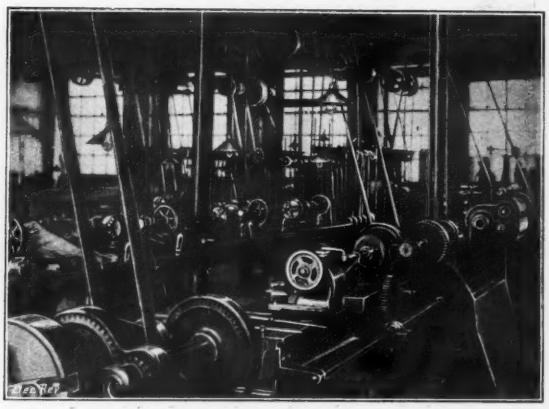
Elsewhere there are provided a shop for tool making and press work, an inspection room for small work, and depart-



Mining Switchgear arranged as an Ironclad Switchboard.

ments devoted to the construction of medium size switchgear, controllers, &c., coil winding and testing. The top floor is naturally reserved for the lighter class of work, such as knife switches, switch fuses, circuit breakers, fuses, &c., but it also contains pattern and instrument making shops, and an enamelling shop.

out by the firm, which it will be seen builds a very substantial type of switch for heavy service, such as in mines and factories, and pays particular attention to interchangeability of parts and ease of adjustment and renewal. In the case of mining switchgear, switches of 100 to 600 amperes



A Corner of the Machine Shop.

capacity are standard lines, while switches for use on switchboards ranging from 15 to 4,000 amperes capacity are also made. The firm always employs a toggle action in its switches, also standard contact units, which can be varied

in number as required, and nowadays the porcelain insulators in oil switches are readily replacable, the older grouted-in insulator having been superseded.

During our visit many examples of mining switchgear for both low and high pressures were shown to us, and we illustrate an ironclad switchboard built up of mining units, and including bus-bar chambers, isolating links, trifurcating boxes, instruments, &c.

It may be noted that the overload and no-voltage trip coils are oil-immersed, as well as the current and potential transformers where these are necessary, thus providing perfect insulation; also that the switch parts and tank lowering gear are interlocked with the isolating links in order to ensure the operation of the oil switch prior to interference with the former gear.

We also illustrate two types of auto-starter; these are built for either star-delta or auto-transformer control, and can be fitted with automatic trips as required.

The firm does a large business in direct-current circuit-breakers, of the loose handle laminated brush type, fitted with carbon break and magnetic blow-out, for switchboard use, as well as in instruments for the same purpose.

In conclusion, it will be seen that the new company commences business under excellent conditions and well equipped to meet the exigencies of present day trade.

COPPER.

THE sudden and heavy fall in price continues to be the subject of constant discussion. As is pointed out by the writer of an article in the *Times* (February 10th), the price at the beginning of last month for standard was £76⅜, while it is now little above £66, and touched this figure during the past week. The Balkan war is, of course, responsible for a general depression, but besides this the writer alludes to the stocks accumulating in the United States, and the fact that production has increased considerably. Production in that country is considerably ahead of the home consumption. In Europe, there is still a considerable margin between supplies and deliveries. Three-quarters of the European supply coming from United States, this must naturally be so. To the increased production and running ahead of consumption, the writer of the article attributes the reduction of the price by the American copper producers, from 17¾ cents to 16½ cents per lb., which was the determining factor in the present fall.

In view of the fluctuations which affect the price of commodities when the greater part of the production is under one control, it is always good news to hear of fresh sources of production not yet tapped by the combines. A pamphlet is to hand containing reports of discoveries in the Russian Island of Nova Zembla, which, without claiming to be final so far as quantity is concerned, shows that considerable native outcrop copper is present in the district investigated. It claims to have proved the existence of two cupriferous veins of an average thickness of 1·5 to 2 metres each, and that these veins extend over a length of more than 2 kilometres; also that deposits of chalcopyrite ore are present in the district (Miedny Peninsula). Concessions have been granted to a company in course of formation. Apparently, though in latitude 71·8° north the climate is naturally severe (average winter temperature — 15° to — 20° C.), yet there are settlements on the same island even further north which are inhabited the whole year round. The veins are under a kilometre from the coast.

So long as the United States continues to produce more than half the copper consumed in various parts of the world, it will naturally remain the dominant factor in any consideration affecting the copper market. The time when other parts of the globe will produce quantities allowing them to measure themselves with the United States in this respect does not, apparently, approach any nearer; on the contrary, the present policy of the United States producers appears rather to be one of holding back than of putting forth more effort to increase production. The usual annual summary of copper production figures appearing in the *Mining and Engineering World of Chicago* for January 25th, gives a useful and exhaustive summary of copper statistics for last year (1912). The present rate of consumption, we learn, may be largely increased by the use of copper in steel rails, on which experiments are being made. The presence of 1¼ per cent. of copper appears to increase the useful life considerably. The use of copper for ornamental purposes is referred to, and even watch dials run into some hundreds of tons annually.

The increase in output of 1912 is the largest yet recorded, amounting to 230 million pounds (from estimates, final figures not being yet available).

In 1912 the United States produced 550,000 tons, against 490,000 in 1911. This is out of a world's production estimated at 977,000 tons. Against this production other figures show small, though many of them are quite healthy. Mexico is second with 68,000 tons, Japan shows third with 58,000, Australasia has 47,000, Canada 32,000, Russia 29,000, Germany 24,000 and Africa 20,000. The increases (over 1911), provided these figures are sufficiently near, are United States 15 per cent., Japan 5 per cent., Australia 7½ per cent., Canada 30 per cent., Germany 10 per cent. and Africa 15 per cent. Spain and Portugal alone show a decrease of 50 tons in an output of 50,000.

A table of the proportionate production of the United States to that of the globe is also given. This shows the percentage 16·2 in 1880, rising very steadily till 1895, when it was 50·8 per cent., then jumping to 55·0 for two years, afterwards declining, but attaining a maximum of 58·1 per cent. in 1906, and now being, according to the above figures, 56 per cent. As the figures assumed such large proportions the increase in the world's production fell off slightly, being 6 per cent. per annum for the latter half of the last century; in the present one it has been nearer 8 per cent. Variations have, of course, occurred, as in 1907, when the output was less than in the preceding year, but, taking the increase over the 12 years, the average will be found near this amount.

The leading territory in the United States for copper production is Arizona, which passed Montana in 1907. Its last year's output is estimated at 160,000 tons. Montana comes second with 138,000, Michigan third with 104,000, and Utah fourth with 65,000.

The Porphyry mines in Utah, Nevada, Miami, &c., are estimated to have produced 114,000 tons of the total. In Montana only one property—the North Bulte—has deteriorated in producing ability and reserve of ores. In Lake Superior district, Calumet and Hecla mine shows a decrease of some 2,000 tons.

Coming to stocks, the beginning of the new year shows an increase of 7,000 tons over the end of the preceding one. Stocks were lowest in July, falling off since the commencement of the year, with heaviest drop in January. Production was highest in August and lowest in February—the difference between the two 12,000 tons, on an average of about 45,000. Domestic deliveries were highest in October and lowest in February.

Export deliveries were highest in January and lowest in April. Production increased 10 per cent. over 1911, domestic deliveries 15 foreign deliveries fell 1 per cent., and total deliveries gained 6 per cent.

The world's stocks as on December 31st were about 5,200 tons less than for the same date in the previous year.

On the financial side, 14 companies increased their dividends during the year, and four commenced paying dividends.

The lowest price for Lake Superior copper was in January 14¼ cents. The highest was 17⅞, which appeared several times in June, August, September, November and December.

Electrolytic advanced pretty steadily throughout the year, being 14¼ cents (low price) in January, and standing at 17⅞ (high price) from June onwards. Consumers, it appears, still refuse to carry heavy stocks of the metal, and thus refrain from stimulating the market with heavy orders. At the same time, the writer of the article considers that indications point to the first quarter of 1913 as a satisfactory one so far as dividends are concerned.

The influences on this market are at present so numerous that figures relating to it are of especial interest. In England the market is waiting for a clearer European outlook, and better conditions generally; in the United States the situation is affected by the Mexican war, by the question of production, and by the rumours concerning the health of one of the owners. The figures given by Messrs. Merton in their mid-monthly circular show an increase in the European visible supply for February 15th of 1,561 tons over the figures for January 31st. French stocks have increased 499 tons, and Dutch 1,430; Germany (Hamburg) is estimated to have increased 885 tons. English stocks, on the other hand, are 853 tons less.

Supplies from North America are heavy, though, of course, the half-monthly figures cannot be taken as being necessarily half the month's supply. Spain and Portugal's contribution is very small, Chile shipments are slightly low, Australian well maintained. The quantity afloat from Australia is large, 6,000 tons. The total deliveries are very fair at 22,993 tons, if the same rate be maintained. The average per month is 42,700 tons, and a 50,000-ton month is not often recorded, though last February exceeded that quantity.

More New Terms.—The proposal of a Standards Committee, composed of representatives of German and Austrian technical societies, to adopt the appellation "Neupferd" (new horse) for the unit of power (102 mkg./sec. = 1 KW.), has not met with general favour. In consequence, the Committee now puts forward alternatively "Grosspferd" (great horse), a term which of itself indicates that it is a unit of greater magnitude than the old (in the ratio of 102 to 75 mkg./sec.). What success awaits this new creation (says the *Zeit. für Oest. Ing. u. Ark.*) remains to be seen.

For our part, we shall simply go on calling it the kilowatt.

The Electric Smelting of Copper Ore.—It is stated that the Union Minière du Haut Katanga, which is the Belgian company engaged in the production of copper ore in the Katanga district of the Belgian Congo, and which placed a large quantity of raw copper on the Antwerp market for the first time in 1912, proposes to form a subsidiary company for the electro-metallurgical treatment of copper ore. The scheme contemplates the utilisation of waterfalls for this purpose.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—MR. H. T. BATES, who until recently occupied the position of resident engineer to the South Metropolitan Electric Tramways and Lighting Co., has been presented with a marble clock by his late colleagues. Mr. A. V. Mason, the general manager, in making the presentation, regretted Mr. Bates's resignation, and congratulated him on his appointment as resident manager to the Rothesay Tramway Co., wishing him every success in his new sphere.

The Torquay T.C. has increased the salary of MR. KEENAN, chief assistant engineer at the Electric Light Works, from £166 to £180 per annum.

The Barrow-in-Furness T.C. has increased the salary of the borough electrical engineer, MR. H. R. BURNETT, from £500 to £550 per annum.

The Dewsbury T.C. has increased the salary of MR. R. W. GRUBB, assistant electrical engineer, from £170 to £180 a year, rising by £10 per annum to a maximum of £200.

MR. J. MARTIN BLAIR, who was the Acton Council's electrical engineer from the inception of that authority's electricity undertaking until the transfer of the business to the Metropolitan Electric Supply Co., Ltd., has now severed his connection with the company, by whom he was engaged as local representative after leaving the Council's employment.

The St. Helen's T.C. has increased the salary of MR. J. W. WARR, outside superintendent at the electricity works, from £180 to £200 per annum.

BAILIE SMITH and MESSRS. P. G. STEWART and HANNAY, have been appointed, along with MR. W. W. LACKIE, chief engineer, by the Electricity Committee to represent Glasgow T.C. at the 18th annual conference of the Incorporated Municipal Electrical Association to be held in London in June.

The Bristol T.C. has increased the salary of MR. C. M. DAVIS, commercial engineer, to £200 per annum, and that of MR. A. J. NEWMAN, distribution superintendent, to £225 per annum.

The Electricity Committee of Bermondsey B.C. has decided to increase the salary of the electrical engineer (MR. W. E. J. HEENAN) by two annual increments of £50, to £625 per annum; also the salary of MR. L. A. LAWS (mains superintendent) from £185 to £200 per annum.

The salary of MR. J. H. BOWDEN, electrical engineer to the Poplar undertaking is, subject to the usual sanction, to be increased from £600 to £700 per annum, as from January 1st last. It is stated by the Council's responsible Committee that the salaries paid to the engineers of other electricity undertakings in London with similar outputs are considerably higher than that paid to Mr. Bowden, and under the circumstances they think that he is fully entitled to the increment.

On Friday evening last, at Bexley Heath, MR. CHAS. MITTELHAUSEN, late electrical engineer and tramway manager to the Bexley U.D.C., was presented with a pair of binoculars and a clock by the members of the various municipal departments. Councillor E. J. Reid presided, and the new electrical engineer, Mr. P. J. Stokes, was among those present. Councillor Reid, who had been for four years chairman of the Electricity Committee, said he had always found Mr. Mittelhausen the soul of courtesy and loyalty, and he congratulated him upon the results of his labours. Mr. Mittelhausen replied in suitable terms, and a few words from Mr. Stokes followed. The arrangements were made by Mr. S. Stone. On the following day, at a concert, the employés of the lighting and traction departments presented their late chief with a silver cigarette case.

General.—We have received a cutting from the *New York Herald*, reporting that last Saturday week at Halifax, N.S., Capt. Larnder, R. D. Legatte, watch officer, and James Himmelman, boatswain's mate, all of the cable steamship *Mackay-Bennett*, were honoured by the Dominion Government for a gallant rescue at sea. A handsome loving cup was presented to Capt. Larnder, a pair of binocular glasses to the watch officer, and a gold watch to the boatswain's mate. "It was just a year ago on the Georges Bank that between heavy snow squalls and heavy weather the officer of the watch on the *Mackay-Bennett* thought he saw a vessel flying a signal of distress. A search was made, and at last the schooner *Caledonia*, heavily coated with ice, leaking, and her pumps choked, was observed. A boat in charge of Himmelman put off to the rescue, and the crew of six men were taken off the disabled vessel. The *Caledonia* was taken in tow, but when 60 miles from Halifax she capsized because of the tremendous weight of ice on her rigging and sides."

The *Times* states that in consequence of the absorption by the Underground Railways, Ltd., of the Central London Railway, MR. CECIL PARTRIDGE, general manager of the latter company since 1911, has accepted an offer of compensation, and will shortly retire.

Our readers will be interested to learn that MR. J. H. RIDER is leaving South Africa for a short holiday in the course of a month or two, and he will be in this country before Midsummer.

MR. R. H. CRIDGE, formerly of Messrs. Siemens Bros. Dynamo Works, Ltd., has been appointed by the Electrical Apparatus Co., Ltd., as their London representative for motor control and switchgear.

MR. CHARLES J. CLOSE has been appointed to represent the Marconi International Marine Communication Co., Ltd., in the North-Eastern Counties. Offices have been acquired at Milburn House, Newcastle-on-Tyne. The registered telegraphic address of the North Country branch is "Expanse, Newcastle," and the telephone number is "Central 1125."

MR. H. R. KEMPE, who, as our readers are aware, recently retired from the position of principal staff engineer and electrician to the Post Office, was on Monday last presented with a silver tea and coffee service by Mr. W. Slingo, engineer-in-chief, on behalf of his colleagues and friends at St. Martin's-le-Grand.

MR. C. D. CROMPTON has recently severed his connection with the Post Office Telephones, Manchester, and has taken up a position on the staff of Messrs. L. E. Wilson & Co., 20, Cross Street, Manchester. Before leaving he was presented by his late colleagues with a fountain pen.

MR. O. L. REMINGTON, manager of Messrs. W. McLean & Co., electrical merchants, of Melbourne, has arrived in London, and his address is at the Hotel Cecil. He is open to confer with firms and others who have special lines of manufacture for introduction to the Australian market.

Obituary.—MR. GEORGE MATTHEY, F.R.S.—We regret to record the death of Mr. George Matthey, which occurred on 14th inst. at Eastbourne. The deceased gentleman was 87 years of age, and he had been practically all his life a member of the well-known firm of Johnson, Matthey & Co., Ltd., of Hatton Garden, London. He joined it at the early age of 19, and a few years later became a partner. He relinquished his active association with the business some seven years ago. The *Times*, in alluding to Mr. Matthey's career, mentions his early interest in the development of platinum for commercial purposes, including chemical apparatus and electric lamps. "The iridio-platinum of which the standard metre was made was manufactured by his firm under his direct superintendence." He was decorated with the Legion of Honour, and in 1879 was made an F.R.S.

NEW COMPANIES REGISTERED.

Teleca Co., Ltd. (127,163).—This company was registered on February 18th, with a capital of £2,000, in 1,750 participating ordinary shares of £1 each, and 5,000 deferred ordinary shares of 1s. each, to carry on the business of engineers, contractors, &c., and to acquire certain patents for an invention relating to a telephone cord attachment. The subscribers (with 100 participating ordinary shares each) are:—E. V. Cheese, 1, Albemarle Street, W., merchant; P. C. Anderson, 9, Gourtfield Gardens, S.W., accountant. Private company. The number of directors is not to be less than two or more than five; the subscribers are to appoint the first; qualification, 100 shares; remuneration, £50 each per annum, after 5 per cent. is paid on the participating ordinary shares. Registered by E. Anderson, 329, High Holborn, W.C.

London Commercial Electrical Stores, Ltd. (127,131).—This company was registered on February 12th, with a capital of £1,000 in £1 shares, to take over the business carried on at 65-7, Knightrider Street, E.C., as the "London Commercial Electrical Stores," to carry on the business of electricians, manufacturers of and dealers in all kinds of electrical apparatus and sundries, &c., and to adopt an agreement with F. Taussig. The subscribers (with one share each) are:—H. H. Kemp, 35, Alexandra Park Road, Muswell Hill, N., clerk; F. Taussig, 65-7, Knightrider Street, E.C., electrical engineer. Private company. The number of directors is not to be less than two or more than three; the first are F. Taussig (governing director), and P. J. White; remuneration of governing director £350 per annum. Registered office, 65-7, Knightrider Street, E.C.

Electricity Meters Patent Development Syndicate, Ltd. (127,175).—This company was registered on February 14th, with a capital of £800 in £1 shares, to acquire British and Canadian patents granted to A. M. Billington and W. H. Johnson relating to electricity meters, and to adopt an agreement with the Johnson-Billington Electricity Meters, Ltd. The subscribers (with one share each) are:—H. B. Spiller, 28, Hastings Road, Ealing, W., stockjobber; H. Harrison, 11, Victoria Street, S.W., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are H. B. Spiller, H. Harrison and C. W. B. Bridson; solicitor, J. T. Goddard, 5-6, Clement's Inn, W.C. Registered office, 155, Salisbury House, London Wall, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Varley Magnet Co., Ltd.—Particulars of £2,500 debentures, created January 21st, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £1,400. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Bryant Trading Syndicate, Ltd.—Mortgage debenture, dated January 23rd, 1913, to secure £5,000, charged on company's undertaking and property, present and future. Holder: J. T. Bentley, Dovercourt, Essex. This debenture ranks subject to debentures already issued by the company to Messrs. Jaggard & Golding, but in priority to the debenture issued to C. B. James for £24,000.

C. H. Hare & Co., Ltd.—Present capital £16,000 in £1 shares (8,000 pref.); original capital, £12,000 in £1 shares (4,000 pref.); increased to present amount February 26th, 1912. Return dated December 30th, 1912; 5,200 pref. and 8,000 ord. shares taken up; £1 per share called up on 5,200 pref. and 502 ord.; £5,702 paid; £7,498 considered as paid on remainder. Mortgages and charges: £2,500.

X.L. Electric Co., Ltd.—Debenture dated January 15th, 1913, to secure £400, charged on the general assets. Holder: Capt. C. Wiener Ewell.

Electricity Supply Co. for Spain, Ltd.—Particulars of £250,000 debentures, created November 30th, 1898, and having the benefit of a trust deed of same date, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £6,000. Property charged: The company's undertaking and property, including uncalled capital. Trustees: A. R. Monks, 123, Cannon Street, E.C., and C. Hill, 88, Leadenhall Street, E.C.

Alfred A. Secrett, Ltd.—Debentures dated December 31st, 1912, to secure £105, charged on the company's undertaking and property, present and future. Holder: F. W. Lavers, 75, Waddon Road, Croydon.

Blackpool, St. Anne's and Lytham Tramways Co., Ltd.—Particulars of £20,000 debentures, created by resolutions of January 12th and March 13th, 1905, and December 23rd, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the amount of the present issue being £5,000. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Sykes & Sugden, Ltd.—Mortgage dated January 22nd, 1913, to secure £720, charged on leasehold land in Spring Place, Huddersfield, with the Spring Place Works thereon, and machinery, shafting, &c., therein, also leasehold land in George Street, Huddersfield, with dwelling house, &c., thereon. Holders: Huddersfield Equitable Permanent Benefit Building Society, Huddersfield.

Filaments, Ltd.—A memorandum of satisfaction in full of debentures, dated February 11th and January 1st, 1910, securing £220, has been filed.

G. H. Turner & Co., Ltd.—Issue on January 28th, 1913, of £100 debentures, part of a series of which particulars have already been filed.

Strode Co., Ltd.—Particulars of £15,000 debentures, created January 20th, 1913, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the amount of the present issue being £12,500. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

I.T.C., Ltd.—A memorandum of satisfaction to the extent of £1,600 of debentures, dated July 26th, 1910, securing £3,000, has been filed.

New System Private Telephone Co., Ltd.—A memorandum of satisfaction to the extent of £1,000 on January 8th, 1913, of debentures dated January 7th, 1908, securing £3,000, has been filed.

United Electric Car Co., Ltd. (formerly Electric Railway and Tramway Carriage Works, Ltd.)—A memorandum of satisfaction to the extent of £20,000, on January 1st, 1913, of mortgage dated November 28th, 1901, securing £50,000, has been filed.

Magneta Time Co., Ltd.—Debenture dated February 3rd, 1913, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: M. D. Fox, 103, Philbeach Gardens, S.W.

Amazon Telegraph Co., Ltd. (44,532).—Capital, £250,000, in £10 shares. Return dated December 2nd, 1912. All shares taken up. £250,000 paid. Mortgages and charges: £295,800.

Douglas Southern Electric Tramways, Ltd. (45,701).—Capital, £50,000 in 30,000 pref. and 20,000 ord. shares of £1 each. Return dated December 17th, 1912, filed January 8th, 1913. 25,973 pref. and 15,472 ord. shares taken up. £1 per share called up on 12,566 pref. and 5,804 ord. £18,370 paid. £23,075 considered as paid on 13,407 pref. and 9,668 ord. Mortgages and charges: Nil.

Costa Rica Electric Light and Traction Co., Ltd. (56,447).—Capital, £130,000 in £1 shares. Return dated January 3rd, 1913. All shares taken up. £7 paid. £129,993 considered as paid. Mortgages and charges: £267,700.

Foster Engineering Co., Ltd.—Issue on February 7th, 1913, of £2,000 debentures, part of a series of which particulars have already been filed.

Accumulator Industries, Ltd. (67,180).—Capital, £40,000 in £1 shares. Return dated January 14th, 1913; 37,006 shares taken up; £1 per share called up on 26,506; £26,484 paid, leaving £22 in arrears; 10,500 shares considered as fully paid. Mortgages and charges: Nil.

Electromobile Co., Ltd.—Issue on January 30th, 1913, of £309 15s. debentures, part of a series of which particulars have already been filed.

James Keith & Blackman, Co., Ltd.—Issue on February 12th, 1913, of £1,000 debentures, part of a series of which particulars have already been filed.

Foreign and Colonial Lighting Co., Ltd.—Charge on company's undertaking, property and rights of all kinds, dated February 12th, 1913, to secure £210. Holder: A. B. Reikett, Kenmore, Highlands, St. Leonards-on-Sea.

Pontelec Welding Patents, Ltd. (107,935).—Capital, £30,000 in £1 shares (20,000 ord. and 10,000 pref.), return dated January 2nd, 1913; 20,000 ord. and 5,000 pref. shares taken up; £5,000 paid on the pref., £20,000 considered as paid on the ord. Mortgages and charges, £1,800.

CITY NOTES.

Late City News.

JUST as we are going to press there has arrived a batch of company reports, from which we extract the following. The full reports will be referred to further next week:—

Bruce Peebles & Co., Ltd.—Results less satisfactorily than 1911. Adverse balance, £4,594. Trading seriously affected by strikes and consequent disorganisation. Prospects now better, owing to improving prices and demand. Meeting, Edinburgh, February 28th.

British Electric Transformer Co., Ltd.—Satisfactory results. Available balance, £24,714; reserve, £9,000: preference dividend, £2,597; 10 per cent. dividend on ordinary shares, £7,895; directors' extra remuneration, £1,106; carry forward, £4,117. Meeting, February 28th.

W. T. Henley's Telegraph Works Co., Ltd.—Profit, £92,069, less fees, debenture interest, depreciation, &c., £23,986 = £68,083 + £36,862 brought forward and £4,041 Bahama Florida securities. Total, £108,987. Put to depreciation of securities, £4,219; to reserve, £15,000; bonus distributing Bahamas Florida fund, £4,000; preference dividend, £9,000; dividend on ordinary shares (15 per cent.), £30,000; carry forward, £45,017. Meeting, February 28th.

Para Electric Railways and Lighting Co., Ltd.—Revenue, less expenses, £133,038. After providing for interest and sinking fund, preference dividend, depreciation (£15,000), contingencies (£15,000), 5 per cent. is paid on ordinary shares, and £9,870 carried forward. Operating expenses decreased; difficulties overcome. Meeting, February 28th.

Telegraph Construction and Maintenance Co., Ltd.—Net profit £109,619 + £106,658 brought forward = £216,277. Interim dividend, 5 per cent., £22,410; further dividend, 10 per cent. and bonus of 12s. per share, require £67,230; reserve fund, £20,000; carry forward, £106,637. General business of the year satisfactory. Meeting February 27th.

London Electric Supply Corporation, Ltd.—Profit £68,670, compared with £61,412. Available after debenture interest and sinking fund £40,983. Preference dividend, £26,952; 2½ per cent. on ordinary, £8,325; contingencies, £1,000; carry forward, £4,706. New reserve fund opened in form of sinking fund account, to receive £12,000 annually for redeeming debenture stock in 1931. Supply for traction 75 per cent. increase, and for industrial purposes 26 per cent.; units sold advanced from 20½ to 28½ millions; total costs reduced by 20 per cent. To meet L. B. & S. C. demand new capital (£250,000) will have to be raised. Meeting, February 27th.

Mackay Companies.—The report states (says the *Financier*), that the profit and loss account for the past year shows the following results: Receipts.—Income from investment in other companies, $4,136,009. Disbursements.—Dividends paid on the Mackay Companies' preferred shares, $2,000,000; dividends paid on the common shares, $2,069,020; operating expenses, $31,323; leaving to be carried forward $35,665. The most notable event of the year in connection with the Mackay Companies is an invention by Mr. John Gott, who has been the chief engineer of the Commercial Cable Co. since its organisation in 1884. He has invented a device by which the Morse dot-and-dash signals can be used on long submarine cables—that is to say, messages can be sent by the ordinary landline Morse key and read on a Morse sounder. The far-reaching effect of this invention on all kinds of telegraph transmission, both by land and sea, cannot at this time be definitely stated, but the Commercial Cable Co. believes that, by this invention, it will be possible to transmit, through automatic repeaters, telegraph signals around the world. The Commercial Cable Co. has acquired the rights to this invention, and has taken out patents all over the world.

African Trans-Continental Telegraph Co., Ltd.—The liquidator (Mr. P. J. Baird), presiding at a meeting held at 2, London Wall Buildings, E.C., on 13th inst., referred to the impracticability of realising an undertaking of this nature by sale in the ordinary way. There were matters difficult to overcome consequent upon terms arranged for the extensions into Portuguese, German, and other territory. They hoped that present negotiations with the Imperial and the German Governments might result in the adjustment of these difficulties and the continuation of the service. They were now waiting for the reply of H.M. Government to proposals submitted last October, and meanwhile the service was being continued under a guarantee by the British South Africa Co. against loss on working. The meeting is reported in the *Times* of February 14th, from which we gather that "under no conceivable circumstances" will there be any return to the shareholders "who must . . . . . write off their shares as valueless."

Continental. — SWITZERLAND. — La Société Franco-Suisse pour l'Industrie Electrique, of Geneva, is declaring a dividend of 5 per cent. for the last financial year, as compared with only 4½ per cent. in the preceding 12 months.

HUNGARY.—The Felten und Guilleaume Ungarische Kabelfabrik Gesellschaft, of Budapest, reports a profit of £29,647 for the last financial year, as compared with only £27,454 in the preceding 12 months. The dividend is being increased from 16½ to 17½ per cent.

Gateshead and District Tramways Co. — The directors have resolved to recommend (subject to audit) that a dividend at the rate of 7 per cent. per annum be paid on the ordinary shares for the half-year ended December 31st, 1912, making with the interim dividend at the rate of 5 per cent. per annum for the half-year ended June 30th, 1912, paid on September 20th last, a total of 6 per cent. for the year 1912, and that in addition a bonus of 1 per cent. be paid on the ordinary shares. The annual meeting is called for March 13th.

Stock Exchange Notice.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £53,000 5 per cent. 50-year mortgage bonds of £100 each

German Electrical Companies.

THE *Deutsche Gluhlampen Fabrik of Plauen*, which was formed in 1910, with a share capital of £100,000, has just decided to reduce the capital to £50,000. At the same time, preference shares of from £12,500 to £25 000 are to be issued to provide working capital.

The *Berlin Elektromobil A.G.* has terminated the financial year 1911-12 with a deficit of £149,000, which is practically the same as in the preceding year, the share capital being £150,000. When the Halensee depôt has been sold, and certain actions for damages have been settled, the liquidation can be closed. The depôt is booked at £37,000, whilst mortgages of the same amount are in operation.

The *Helios, Elektrizitäts A.G., of Cologne*, the liquidation of which is occupying several years, disposed of Roumanian investments at Braila and Bucharest in 1911-12, as well as the holding in the Altona-Blankenese Railway. Further payments were made to creditors, and the debenture-holders have now received 75½ per cent. in cash, and the banks 80 per cent. An interest is still held in two supply works and one tramway. The deficit remains at £419,000, as in 1910-11.

The *Moore Licht, A.G., of Berlin*, which was formed in 1910, and has already been subject to one scheme of financial reconstruction, has now convened an extraordinary meeting to consider a further reorganisation in view of the fresh loss of £13,000 incurred in 1911-12. It is now suggested that the preference and ordinary share capital of £70,000 should be reduced to £9,500, and that a further issue of preference shares of £3,000, having a prior right over existing preference capital, should be made. The patents for the Moore light for France and Belgium are to be sold.

The *A.E.G.-Lahmeyer Werke, of Frankfort-on-Main*, which took over the dynamo works of the Felten & Guilleaume Co. two years ago, report gross profits of £35,500 for 1911-12. After meeting general expenses and placing £2,340 to depreciation, as against £2,380 in 1910-11, the net profits are returned at £31,900, as compared with £28,800 in the six months forming the previous and first financial year. A dividend of 6 per cent. has been declared on the share capital of £500,000, this being the same rate as in 1910-11 for six months.

The liquidation of *E. H. Geist, Elektrizitäts A.G., of Cologne*, reporting on the year 1911-12, states that manufacturing operations were continued until January 1st, 1912, when the works were taken over by the Colonia Electricity Co., which then completed the unfilled orders on the books. The accounts show gross profits of £9,600 in 1911-12, as compared with £7,200 in the previous year, the former sum being absorbed by general expenses and depreciation. The debit balance remains at £24,000 on a total share and loan capital of £55,000. It is stated that the Colonia Co., which was granted an option for five years on the works, plant and site, has not exercised the right as yet.

The *Bergmann Elektrizitäts Unternehmungen A.G.*, which was formed to financially promote railway construction and central stations on behalf of the parent company (Bergmann Electricity Works Co.), has closed the year 1911-12 with a fresh loss, which amounts to £17,000, as compared with a loss of £15,000 in 1910-11. The directors' report states that further progress was made in the business of the railway department, but activity in the central station department was suspended, and the work restricted to the completion of the undertakings in hand. The limitation in this direction is in accordance with the programme decided upon some time ago.

Mather & Platt, Ltd.—The directors' report, as abstracted in the *Times*, states that the net profits for 1912, after charging depreciation and directors' remuneration and expenses, amounted to £144,749. The directors have transferred to the works removal account £30,000, leaving £114,749, plus the balance brought forward, making a total of £147,506. The directors recommend a dividend of 10 per cent. per annum, free of tax, on the ordinary shares (less the interim dividend), together with a bonus of 2 per cent. free of tax, and propose to transfer to reserve account £20,000, and to carry forward £35,506. The large extensions at the company's Park Works referred to in last year's report have been carried out. The directors do not anticipate that any further allocation from profits will be necessary in respect of works removal.

Underfeed Stoker Co., Ltd.—The directors (according to the *Financier*) have declared a dividend at the rate of 2½ per cent. per annum.

City of London Electric Lighting Co., Ltd.—The directors have decided, subject to completion of audit, to place £50,000 to reserve, and to recommend dividends of 12s. per share (at the full rate of 6 per cent. per annum) on the preference shares, and 16s. per share (at the rate of 8 per cent. per annum) on the ordinary shares. On account of these dividends, 6s. per preference share, and 6s. per ordinary share, was paid in September, 1912, and the balance remains to be paid. After payment of the dividends and other appropriation, there will remain about £24,000 to be carried forward. In addition, the directors have also decided to recommend a bonus of 2s. per ordinary share (less income-tax) out of the amount standing to the credit of the dividend equalisation fund.

Metropolitan Railway Co.—At an extraordinary general meeting, held on 12th inst., the proposal to acquire the G.N and City Railway Co.'s undertaking was approved by an overwhelming majority.

St. James's and Pall Mall Electric Light Co., Ltd.

MR. M. R. PRYOR (chairman) presided on Tuesday at the offices, Carnaby Street, S.W., over the annual meeting of this company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 270), the CHAIRMAN referred with regret to the absence of Mr. Leaf, the chairman, who had an attack of influenza. He also asked the shareholders to join with the board in sympathetic regret at the death of Sir J. H. Morris, who was the senior member of the board. They would, doubtless, know that Mr. F. J. Walker became the manager and secretary of the company at a time of very great anxiety, and it was due, in the first place, to his efforts, that the present situation of the business—second to none, he ventured to say, for soundness and success amongst the electric companies of London—was due. The board had considered that Mr. Walker's exceptional services deserved exceptional recognition, and they had, therefore, invited him to take the vacant seat on the board, but with the title of managing director. They had appointed him to the post for a period of five years, during which he would not be subject to the condition of retirement imposed on the other directors. He trusted that was entirely in accordance with the shareholders' wishes, and he need hardly say he looked on it as a very important benefit to the company to secure the services of Mr. Walker in the dual capacity. On reading through the accounts, they must have been struck with the similarity they showed to those of the previous year. The sale of electric current, although still showing the effects of the metallic-filament lamp, and by no means so elastic as they could have hoped it would have been, showed some improvement. Connections had increased by no less than 634 KW., and the units sold had gone up a little more than 300,000. The gross revenue from the sale of current had increased by £2,300. There had been an almost similar increase in the cost of generation, viz., £2,100, and the ultimate result arising from various differences too small to call attention to, although they were kept well in view by the board, was that the balance available for dividend was £54 less than last year. In view of a fact, to which he would refer later, this result was, in their opinion, very satisfactory, and it was a good deal better than they had dared venture to hope for a year ago. He would like to draw attention to the fact that this did not involve any difference in the sums put aside for depreciation and contingencies. Last year the chairman told them they had in view the replacement of some old and obsolete units at Carnaby Street station by new transforming generators and accumulators. They had steadily pursued the policy of keeping the station up to date, and the first stage in the improvenent would be carried out in the summer. The appearance of quietude which the figures seemed to show was really illusory. The outstanding feature of the year was the great coal strike, which they were anticipating when they last met, and the storm burst a fortnight later. Their assurance that they had made sufficient provision for any period of time over which the strike could reasonably be expected to last was justified by events, and the store they had accumulated at Grove Road carried them through without the necessity of stinting the supplies in any way, a result of which they ventured to feel somewhat proud. But although the most obvious difficulty was thus averted at the cost of continuous vigilance and anxiety on the part of Mr. Walker and Mr. Dobson, yet the strike left a legacy in the shape of the increased cost of coal, and this he feared they must consider permanent, although part of the increase was due not to the strike, but to the great industrial activity which was characteristic of the past year, and so far showed no sign of decrease. It might interest them to know that the cost of Midland bituminous coal which, at the time of the strike was, on a four years' average 11s. 4d. a ton, rose after the strike to 14s. 9d. per ton, which was a 30 per cent. increase. In view of this great rise, it reflected the highest credit on their engineer, that the total cost of generation had not increased beyond the additional revenue. This had been done by increased efficiency at Grove Road station, on which they relied for the whole steady load, using their Carnaby Street station only to help on the peak. The new 3,000-KW. turbo-generator, of which the chairman spoke last year, had proved of inestimable value, and they had to take into serious consideration on the board of the Central Co. the need of adding more plant of a like character before long. That was not the immediate problem for them there, but he mentioned it as a fresh argument for their policy of converting Carnaby Street from a generating to a transforming station. In the absence of the chairman, he hesitated to analyse the accounts, but they were exceedingly simple and did not contain any points on which he could advantageously dwell.

MR. B. FITCH seconded the motion, and the report was adopted.

On the motion for the re-election of the retiring directors, proposed by the CHAIRMAN, Mr. W. H. Ash and Mr. Patchell congratulated the board on having elected Mr. Walker to his new position.

MR. BOURN proposed a vote of thanks to the chairman and board, and also to Mr. Dobson and the engineering staff.

The motion was carried, and the CHAIRMAN, in reply, heartily reciprocated the words of Mr. Bourn as to the loyalty and hard work of Mr. Dobson and his staff.

MR. WALKER, in acknowledging what had been said regarding himself, remarked that he fully appreciated the high compliment which had been paid him, and would devote the same care and attention, coupled with the same enthusiasm, to the affairs of the company as in the past.

Bournemouth and Poole Electricity Supply Co., Ltd.—The directors have declared a final dividend on the ordinary shares at the rate of 7 per cent. per annum for the half-year ended December, making 6 per cent. for the year, less income-tax

Rand Mines Power Supply Co.

The *South African Mining Journal* contains a report of the fourth annual meeting of this company, held in Johannesburg last month. Mr. F. D. P. Chaplin presided, and said that the report and accounts showed the rapid progress which the company had made since entering the revenue-earning stage, and indicated that there was every prospect of a considerable growth in the company's business in the immediate future. Notwithstanding the fact that they were still partly in the construction stage, they were able to earn a profit of close upon a quarter of a million during the financial year ended August 31st last. This satisfactory result would have been even better but for the unfortunate breakdowns, which involved not only the payment of penalties, but also a considerable loss of revenue, as well as increased expenditure in bringing the plant again into commission. The company's experience in regard to breakdowns appeared to be one which was inseparable from the entry of large generating units into commercial service, especially when, as in this case, the commencement of operations was accelerated on account of urgent and increasing demands for power before sufficient reserve plant was available. However carefully the machine was designed and constructed, reliability could only be secured through experience gained in actual operation. There could be no question, however, that the policy adopted enabled the company to derive the greatest possible advantage in the shape of revenue from the full output of the plant, and at the same time furthered the interests of the consumers by the provision of the available supply of power at the earliest possible date. Adequate arrangements had been made for the extension of the company's generating stations and transmission and distribution systems. Everything possible was being done to provide a sufficient supply of power to meet notified future demands, and, provided that the manufacture of plant and the progress of the extension works were not hampered by delays due to strikes in Europe, and other causes, which had been their unfortunate experience in the past, there was every reason to believe that the company would soon be provided with the full complement of plant and equipment, inclusive of reserve plant necessary to meet all requirements. After the company had commenced operations, experience soon indicated that there were several defects in the agreement between the company and the Rand Mines, Ltd., which would have to be remedied, and certain alterations would have to be made before the contract could be regarded as a workable instrument and satisfactory to the parties concerned. The decision to draw up a new agreement and form of contract was no light undertaking, and not only entailed very difficult negotiations between the representatives of the board, acting with the Victoria Falls and Transvaal Power Co., Ltd., and the representatives of the Rand Mines, Ltd., but also involved an immense amount of labour and care in the preparation of such important documents. This new contract, although not yet finally agreed, was now in the hands of the representatives of this company and the Rand Mines, Ltd., in London, and they expected very shortly to hear that the document has been completed. As the result of the very close relations which had been found to exist between this company and the Victoria Falls and Transvaal Power Co., Ltd., it had been thought advisable to arrange the accounts upon a basis which was not originally contemplated. As a part of this arrangement, it was found advisable that one firm of auditors should audit the accounts of both companies, and it had consequently been arranged, in order to bring this about, that a change should be made in the auditors of this company.

The report and accounts were adopted.

Electrical and Industrial Investment Co., Ltd.

The first ordinary general meeting of this company was held on Monday at Electrical Federation Offices, Kingsway, W.C., Mr. C. Shirreff Hilton, the deputy chairman, presiding in the absence, abroad, of the chairman, Mr. E. Garcke.

The Chairman, in proposing the adoption of the report (see Electrical Review, page 269), said he believed the shareholders would consider the balance-sheet thoroughly sound and satisfactory. During the seven months with which the accounts dealt, they had made a profit, after meeting all administration expenses, of £11,325. That profit was derived from interest and dividends on investments and from fees and commission on financial services. After paying interest on the debentures and the dividend on the preference shares, there remained a balance of £4,943. Out of that it was proposed to write off the whole of the preliminary expenses, amounting to £1,629, and to carry forward the balance of £3,314. There would have been no difficulty in recommending the declaration of a dividend on the ordinary shares, but the large holders of those shares agreed with the directors in the view that the better course was to strengthen the position of the company by building up a large carry-forward in the early history of the company's career. The shareholders could well afford to go without a dividend on the ordinary shares on this occasion, because they received a very handsome return on the liquidation of the City of Birmingham Tramways Co.; and they were receiving a dividend on the preference shares which they held, which was a substantial return on the cash capital they had invested. Of course they were not losing the undivided profits—they were still there, and they would serve to improve the value of the ordinary shares. The company was formed last May, to take over the investments of the City of Birmingham Tramways, Ltd., and the capital was subscribed for the main part by shareholders and debenture-holders of that company. The securities which they took over amounted to over £604,659, but the issued capital of the company amounted to £381,808, so that securities to the extent of about £222,000 had to be realised. That surplus of securities was represented by investments which had been made by the trustees for the debenture-holders of the City of Birmingham Tramways, Ltd., and were made in trustee securities. The nominal value of those securities was £211,400, and they had cost the trustees £219,591. As the yield on those securities was only 3·4 per cent., there was no advantage in raising capital for the purpose of holding them, and they were, therefore, realised. Unfortunately, gilt-edged securities during the last few years had suffered serious depreciation, and the losses suffered on the realisation of those securities by the company amounted to £22,458, or about 10¼ per cent. of the capital amount. It was well, however, that they were sold, for those high-class securities had undergone a still further depreciation, and the losses would undoubtedly have been greater had they been retained. The loss had been charged against the reserve, which had been created to meet depreciation. A part of that reserve was provided by the old company, but a further addition to that fund had been made, and would continue to be made, by adding to it any profit which the company had made, or would make, by the realisation of investments. On the other hand, any loss that might be made on the realisation of investments would be borne by that reserve. By dealing with profits and losses in that way they hoped to establish the company in a strong position. Their policy was to keep the capital account distinct from the revenue account, and to hold all investments at their actual cost—they did not propose to write them either up or down. The present investments amounted to £485,866, and they were spread over 179 investments. Of those the larger proportion were quoted securities, and taking them at the middle price at December 31st, and taking the other securities at cost, the aggregate value was more than the net figure at which they stood in the balance-sheet. The major part of the investments—£261,000—were in the form of debentures and debenture stocks; £126,000 were in preference shares, and only £86,000 in ordinary shares. The board had special facilities which enabled them to gauge the value of electrical investments, and as most of the investments were made by the City of Birmingham Tramways, Ltd., whose powers of investment were limited to tramways and kindred securities, a large number were in electric power and traction undertakings, electric lighting, tramways and railways. It was desirable that they should raise a little further capital by the issue of 4½ per cent. debentures so as to reduce the average cost of their capital, and as opportunity offered, the directors proposed to issue further debenture stock.

Mr. J. A. Christie seconded the motion, and the report was adopted.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

The directors' report to the end of 1912 shows that the renewal and reserve fund account now stands at £115,361, being an increase of £8,746. After providing for the amount placed to that account, and paying the dividends on the 6 per cent. first preference shares to June 30th, 1912, on the 5 per cent. second preference shares to September 30th, 1912, and an interim dividend at the rate of 8 per cent. per annum on the ordinary shares for the first half of the year, the balance standing to the credit of the net revenue account for the year 1912 is £9,159. Out of this £1,500 has been appropriated to the payment of the first preference dividend to the end of the year, and £625 has to be set aside to meet the portion of the dividend on the second preference shares accrued to the same date. It is proposed to pay out of the balance of £7,034 a further dividend on the ordinary shares at the rate of 10 per cent. per annum, for the past half-year, making, with the interim dividend paid on August 16th, 9 per cent. for the year. This will leave a balance of £1,784 to be carried forward.

The meeting is called for February 27th, at 148, Brompton Road, S.W.

Crossley Brothers, Ltd.—The directors report that for the year ended December, 1912, the amount to the credit of revenue account is £56,322, out of which a dividend has been paid on the preference shares, at the rate of 5 per cent. per annum, for the first half of the year, amounting to £10,085. It is proposed to pay a further dividend for the second half of the year at the rate of 5 per cent. per annum on the preference shares amounting to £10,085, and to carry forward £36,153. The decrease in profits is due to the serious reduction in the normal output caused by the prolonged strikes at the Openshaw works during the months of January, February, and September. The meeting is called for February 25th, at Manchester.

Chelsea Electricity Supply Co., Ltd.—The directors recommend a dividend for the half-year to December 31st, 1912, at the rate of 6 per cent. per annum on the ordinary share capital, making 5 per cent. for the year 1912, after paying debenture interest and placing £13,626 to depreciation fund, £704 to debenture premium redemption fund, writing off £1,089 from the cost of extinction of founders' shares, £1,000 from cost of purchase of Cadogan Electric Light Co., and £1,352 off cost of investments; carrying forward £2,832, subject to audit. The dividend is the same as for 1911, and will be payable on and after March 15th.

Westminster Electric Supply Corporation, Ltd.

THE directors' report for 1912 shows that the total power of the lamps, motors and apparatus connected to the company's mains had increased from 35,337 KW. to 37,710 KW. The length of roadway in which continuous-current mains have been laid now exceeds 93 miles, making about 377 miles of ways, into which upwards of 280 miles of copper (strip and cable) have been drawn. In addition six miles of trunk mains (35 miles of ways) are laid in the company's area to connect the stations with the Central Electric Supply Co.'s station at St. John's Wood. An interim dividend at the rate of 9 per cent. per annum on the ordinary shares, and the dividend on the 4½ per cent. preference shares, for the half-year ending June 30th, 1912, have been distributed. After allowing for depreciation, sinking fund and other charges, the net balance is £47,840, from which must be deducted the second half-year's dividend on the preference shares, which absorbed £11,653, leaving £36,188. Out of this the board recommend the payment of a dividend at the rate of 11 per cent. per annum, less income-tax, for the past half-year, making 10 per cent. for the year, carrying forward £7,703.

The meeting is called for February 26th.

Units sold	18,638,125
Used on works for lighting, meter testing, &c. ..	496,376
Total	19,134,501
KW. on circuit	37,710

Liverpool Overhead Railway Co.

THE forty-ninth half-yearly general meeting was held on February 11th, at Liverpool, Mr. Harvey C. Woodward presiding over a good attendance.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, p. 233) regretted that ill-health had compelled Sir William Forwood to resign the chairmanship of the company, and the directors had appointed him (Mr. Woodward) to fill the vacancy. Sir William had been chairman of the company from its inception, and had always taken the keenest interest in its successful working. His colleagues on the board missed his presence greatly, but hoped that he might yet be able to take some part in their deliberations. With the kind assistance of his co-directors and the faithful co-operation of the manager and staff, he hoped to see their little railway steadily improve its position. The directors were gratified at being able to place before the shareholders more encouraging accounts. There had been a considerable boom in the trade of the port, in which that railway had fortunately participated, and which was reflected in their increased earnings. They had carried during the half-year 559,040 more passengers, which yielded an increased revenue of £3,245, at an increased expenditure of £1,181. He could assure the shareholders that they had not neglected the up-keep of the undertaking, but had steadfastly adhered to their policy of maintaining its efficiency. The railway had now been opened 20 years, and it was to-day structurally in as good a condition as ever. The coal strike imposed upon them the necessity of carrying reserve stocks of coal; they obtained a suitable position near their generating station, where they had stocked a good supply. Their traffics were keeping up well, and they had already made three records this year in the number of the cheap workmen's return tickets. It was anticipated that his Majesty the King would open the new Gladstone Dock at Seaforth in July. When that dock was in operation many of the big liners would, no doubt, be transferred to it from Canada Dock, and that, together with the new repair yard of Messrs. Harland & Wolff, adjacent to the railway, should increase their receipts still further in future. The traffic during the past half-year was the best they had had since December, 1900 (an exceptional year, owing to transports for the South African war), and, taking into consideration the serious competition which they had encountered since that date, the result was satisfactory. But he did not wish to make the picture too rosy. They were still exposed to keen competition. The cost of fuel and all materials had steadily increased, and concessions to their staff were a heavy item in increasing their expenses; while the Government, following on the Workmen's Compensation Act, had added a new burden in the shape of sickness and unemployment insurance. In the face of these obstacles to good dividends, their earnings per passenger tended rather to diminish, and last year averaged only 1·67d. per passenger, against 1·93d. in 1904. These fractions did not convey much to a general audience, but on the workmen's cheap tickets the reduction in fares practically amounted to carrying fully 1,000,000 more passengers in 1912 than in 1904 for about the same return in actual money, and they could only rely upon increased traffic for further improvement in their receipts. With regard to the debenture issue, the advance in the Bank of England rate to 5 per cent., and the European war, rather tended to hinder its success, but they succeeded in placing nearly three-fourths of it on the terms of the prospectus. They had still a few thousands to dispose of, and if any of the shareholders or their friends would like a good home investment in a railway earning over three times the interest on its debentures, with the additional guarantee of the Mersey Dock Board, a kind of security that they could sleep over comfortably, they would be pleased to allot their requirements. The directors would hold one meeting a year, which would be in February, but that did not debar them from paying an interim dividend in July or August, when they considered that their traffics ustified that being done.

MR. J. E. ANDERSON seconded the adoption of the report, and the motion was carried unanimously.

South Metropolitan Electric Light and Power Co., Ltd.

THE report of the directors for 1912 states that the revenue account shows a credit balance of £33,933, which, with £3,067 brought forward, makes a total of £37,001. After deducting £12,423 for interest on debenture stock paid and accrued, and for other interest, and £6,504 for interim dividends paid on the preference shares, there remains a balance of £18,073; out of this there is to be paid a final dividend upon the 7 per cent. cumulative first preference shares, requiring £5,004; a final dividend upon the 6 per cent. cumulative second preference shares, absorbing £1,500; there is placed to credit of depreciation account £4,000, to credit of preliminary expenses £2,000, to credit of showroom account £100, and the balance (£5,470) is to be carried forward.

The following figures show the progress of the business :—

Year.	Lamps (35-watt). Connected at end of year.	Increase.	Consumers.	Gross revenue.	Expenditure.	Net revenue.
1909 ..	191,302	13,674	3,916	£41,847	£16,465	£25,382
1910 ..	208,046	16,744	4,305	44,687	17,678	27,009
1911 ..	230.191	22,145	4,697	51,614	20,541	31,072
1912 ..	258,872	28,681	5,263	56,604	22,670	33,933

The new consumers and lamps connected show a greater increase than in any previous year, and the company's showroom continues to be of material assistance to the development of its undertaking. During the year the plant at the power house has been increased by the addition of one 1,500-KW. turbine, which will be put into service shortly. Further connections have been made in the area of the West Kent Electric Co., Ltd. A further £20,000 4½ per cent. first mortgage debenture stock has been issued during the year.

The meeting is called for February 26th at Winchester House, E.C.

City of Buenos Ayres Tramways Co. (1904), Ltd.

THE meeting of this company was held on Thursday last week, at Winchester House, E.C. MR. J. HEATON, in proposing the adoption of the report, said that it was in precisely the same form as they had adopted ever since their fusion with the Anglo-Argentine Co., and the result which they showed was even more satisfactory than in any previous year. The annuity of £70,660 from the Anglo-Argentine was a fixed one, and had been duly received, and the shareholders had received the three quarterly dividends up to September 30th last. Ever since the fusion, it had been a great satisfaction to him as chairman of the company, and as a director of the Anglo-Argentine Co., to refer to the increased revenue of the latter undertaking. For the year 1912 that company would again show an increased revenue, and their annuity of £70,660 would be the first charge upon a sum, roundly speaking, of a million sterling. Their amortisation funds had been fully maintained, but for the past year they had been able to increase the amount placed to the general amortisation fund to £4,500, as against £3,650 for 1911. He explained last year that such would be the case, because they had been able to make new leases of their farm property at figures considerably in excess of the former rents.

MR. E. H. WOODS seconded the motion, and the report was adopted.

Cambridge Electric Supply Co., Ltd.

THE directors' report for 1912 shows that during the year 1912 there have been connected 198 additional consumers, having the equivalent of 6,286 (30-watt) lamps, making a total to date of 82,580. The number of units supplied during the year has been 810,703, an increase of 110,116 units. £3,279 has been transferred from the depreciation account for the purpose of writing off plant which has become obsolete. The accounts show a total profit for the year of £10,172, which, added to £904 brought forward from 1911, makes £11,076. After deducting debenture and other interest £1,927, placing £3,500 to depreciation fund account, there remains a balance of £5,649. An interim dividend of 2 per cent., absorbing £1,696, has already been paid, and the directors recommend the payment of a further dividend of 3½ per cent., making 5½ per cent. for the year. This will absorb £2,968, leaving to carry forward £984. The directors have decided to issue the 577 shares shown in the accounts as the balance of the authorised and unissued capital. They will be in the first instance offered to the existing shareholders and an application form was enclosed with the report. The premiums will be added to the depreciation fund account or reserve as the directors may determine and the capital paid up to reduction of the bank loan. Dr. P. W. Latham has found it necessary to resign his seat on the board owing to his leaving Cambridge. He had served the company as a director for 18 years. Mr. S. R. Ginn has been appointed to the vacancy. The meeting is called for February 25th.

Metropolitan Electric Tramways, Ltd.—An extraordinary general meeting is called for February 24th, to confirm the resolution passed on 7th inst., approving of the new Bill now being applied for.

Newcastle-upon-Tyne Electric Supply Co.—Dividend on ordinary shares for the year, 5 per cent., including 2 per cent interim paid in July.

Tyneside Tramways and Tramroads Co.

THE directors report that for the half-year ending December 31st, 1912, the surplus of receipts over expenses is £4,486, plus £724 brought forward, making £5,210, and after deducting interest on debentures, loans, &c., amounting to £1,006, there remains an available balance of £4,204. A dividend on the preference shares at the rate of 5 per cent. per annum (less income-tax) absorbs £601; a dividend on the ordinary shares at the rate of 2½ per cent. per annum (less income-tax) (the same rate as for the corresponding half-year of 1911), requires £1,674; there is to be placed to the credit of reserve for renewals, depreciation and other contingencies, increasing it to £13,245, £1,400; writing down consols to £75 per cent. absorbs £102, leaving to be carried forward £427. The dividend paid on the ordinary shares for the whole year is an increase of ½ per cent. as compared with the year 1911. The traffic receipts show a decrease of £51 as compared with the corresponding half-year of 1911, but for the whole year there is an increase of £819. The whole of the track, overhead line, and rolling stock, has been kept in thorough repair out of revenue.

	1910.	1911.	1912.
Car-miles (Tyneside Tramway Co.'s cars)	697,218	705,120	717,567
Passengers carried (Tyneside Tramway Co.'s lines)	4,475,721	5,806,241	5,619,201
Total traffic receipts	£23,067	£26,070	£26,888
Gross profit	6,678	8,875	9,456

The half-yearly meeting was held at Newcastle-on-Tyne on 11th inst., DR. J. THEO. MERZ, who presided, said that the traffic receipts for the past year were £26,888, which was an increase on the previous year of £792. That increase was realised in the first half of the year, for there had been a decrease during the second half, owing to the very poor holiday traffic. That latter item was £174 less than in the previous year. Workmen's traffic showed an increase of £200, it was most satisfactory, however, to see that on the whole the increase was on the ordinary traffic. There was an increase in the mileage run mostly on workmen's traffic, which yielded only a small revenue, and also on some experimental services in districts where the local authorities had asked for increased facilities. Those experiments did not pay, and they had lost money by increasing the number of cars. The cost per mile had gone up from 5·64d. to 5·99d. owing to repairs to lines and cars. The repairs to lines would be very heavy, but that expense would be met out of the reserve fund, upon which they had not yet drawn. He referred to the dividends recommended in the report, and said that 2½ per cent. was the largest they had paid. As to the current year, it had opened well, the receipts being slightly more than in the corresponding period of last year.

MR. G. E. HENDERSON seconded the adoption of the report, which was agreed to.

City and South London Railway Co.

THE fifty-seventh ordinary general meeting of the shareholders of the above company was held on the 11th inst. at the offices, 71, Finsbury Pavement, E.C., the Right Hon. C. B. Stuart Wortley, K.C., M.P., in the chair.

The CHAIRMAN, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 232), said their minds were all occupied with the one dominating and unprecedented fact that the passenger receipts for the half-year were less by £6,522, and the balance to net revenue was down by £6,812. This was an even greater fall than he anticipated in November 26th, 1912. It represented the equivalent of a diminution in dividend on the ordinary stock for the half-year at the rate of more than ¾ per cent. It was an effect of the same cause as that which he had in mind when, a year ago, he pointed to the then recent amalgamation between omnibus and railway companies as an example of an arrangement which they ought not to reject should it be offered to them. Its apprehended realisation as the year went on, was what made them enter into the negotiations which he described on November 26th, and approve the terms that on that day they advised the ordinary stockholders to accept from the Underground Railways Co. It had led to their recommending that day a dividend on ordinary stock at the rate of less by 1 per cent. than that which they were able to recommend a year ago. All these facts were part and parcel of a newly emerged state of affairs, which began to affect their traffics in February, 1912, and had since developed into a serious menace to their prosperity as a passenger-carrying industry—he referred to the systematic and determined increased provision of motor-omnibus travelling facilities. He knew of only two ways in which they could contend with an adverse influence such as this. They could level up the attractiveness of their own service, so as to outbid their competitor, or they could come to terms with their competitor in such a way as to make him a partner instead of an enemy. The board claimed that the arrangement that they had made with the Underground Co. combined the advantages of both these policies, and that the application to Parliament, which they recommended them to make, was a necessary part of the necessary policy of improving the attractiveness of the service. The service had fallen behind in the race for public favour because, if judged by modern standards, the trains did not go fast enough and the carriages were not roomy enough. Had the railway been built in 1900, instead of during a series of years ending with 1890, the tunnels would have been made of 11 ft. 6 in. diameter, instead of 10 ft. 6 in. And in respect of speed, as well as of other factors, higher standards could and would have been attained. The chairman entered in some detail into the circumstances that had led up to the present proposals. Not long before the apprehended fall in their traffics became a realised fact, a big combination embracing the District Railway, the three West End tubes, and the London General Omnibus Co., had just been brought about on the principle of replacing cut-throat competition by co-operation and mutual assistance in the service of the public. An offer came their way, which they thought it good enough to give their provisional acceptance; and the result had been that it was accepted by no less than 99 per cent. in value of their ordinary stockholders, and that to a corresponding extent the Underground Electric Railways Co. of London, Ltd., were at this moment owners of the City and South London Railway. That great organisation was now to that great extent interested in seeing to it that their prosperity should not stagnate, that their receipts should no longer fall away, that their line and plant should be modernised and improved, and that they should be linked up physically with, and made comparable in respect of the attractiveness of the service they would offer, with the more modern tube railways that now ran between Hampstead, Highgate and Finsbury Park in the north, right away to Hammersmith in the west, and Elephant and Castle in the south. They would perhaps desire him to describe and justify the proposals they made in the Bill, which they would shortly ask them to approve, rather than that he should make a second speech when the proceedings of the ordinary meeting were over. They proposed to ask Parliament to sanction their enlarging their tunnels wherever necessary from their present small diameter to that of 11 ft. 6 in., which was approximately the diameter of all the four tube railways built since their own. They proposed also to seek power to equip their system with all the needful rolling stock; that was with motors of the desired speed, and carriages of the desired height and width, to bring their service into line as regarded speed and quality with the best and most comfortable of those other systems. That they asked for power to do with capital moneys. Wonderful as it seemed, their consulting engineers told them that this operation of reconstructing the tunnels could be carried out by very short lengths at a time without important interruptions to traffic. Still, they thought it desirable to ask Parliament to protect their preference stockholders by a provision that any loss of dividend to them, arising from whatever cause, during the reconstruction process, might be made good to them out of the capital moneys to be raised under the Bill. The authorised but unissued capital that they had power to raise was £1,150,000 of stock or shares, and £413,363 in debenture stock or other form of loan. The £1,150,000 of stocks or shares might be as to £600,000 in ordinary stock, and as to £550,000 in preference stock. As things now stood under their existing powers, the borrowing powers could not be exercised to any amount above a mere £30,030, except as and when corresponding amounts of share capital had been issued and had produced in money not less than 50 per cent. of their face value. At the present market price of the ordinary stock it would be impracticable to raise money by that means. Consequently in the opinion of the board, the only course to be adopted was to raise the necessary funds by the issue of the £550,000 available preference stock, which would rank *pari passu* with the existing issued preference capital under the Act of 1903, amounting to £200,000. The issue of this preference stock would not prejudice the holders of the preference stock issued under the Acts prior to 1903. Parliament would be asked to allow them unrestricted power to raise the whole of this £413,363 of loan capital without reference to the price or amount of share capital issued. That undoubtedly meant that a sum of £413,363 debenture stock was to be sought to be issued in front of the preference stocks, which, but for the special power sought, could not have been so issued. It would be disrespectful and therefore impolitic for him to enter fully then, and by anticipation, upon the facts and arguments whereby they hoped to commend to Parliament their financial as well as their other proposals. What he might do, and ought to do, was to satisfy their preference stockholders that it was to their interest that these proposals to Parliament should be made. He submitted to them, with all respect, that for that purpose little could be needed in the way of argument. Were they going to remain in all respects as they were a year ago, or two years ago? They might object to taking the risks of adding to prior charges. But they could not remain as they were then, and they did not stand where they stood then. They were neither getting the same traffic nor making the same money. Could anyone doubt that it was better to rehabilitate and improve in good time the earning power of the system so as to make it such as the experience of other systems had shown to be remunerative even against surface competition? And though for this purpose they had to put in front of them an added interest charge of some £16,500 a year, let them look at the weekly traffics, not only as regarded their amounts, but as regarded also their movement and tendency, and judge whether to stay as they were, unimproved, and with shrinking margins, was not a prospect more menacing than that presented by the policy they offered, namely, that of two alternative risks they should take the one which instead of inertia and stagnation gave them that adaptation to their surroundings which was the surest condition of either renewed or continued vitality. Add to this that if the Underground Co., as the owners of the ordinary stock, were interested in improving the dividend on the ordinary stock, they were *a fortiori* the friends and protectors of the preference stockholders.

MR. C. S. GRENFELL seconded the motion, which, after a short discussion, was adopted.

Subsequently, at a special meeting, the Bills to which the chairman referred in his speech, were approved.

Notting Hill Electric Lighting Co., Ltd.

THE directors report that during the year ended December, 1912, the expenditure on capital account was increased by £2,201 to £249,608, and it now exceeds the receipts by £40,255. The cost of the joint station at Wood Lane to date has amounted to £224,340, and joint debenture stock amounting to £227,500 has been issued. This stock is subject to cumulative sinking funds, which now amount to £52,607 invested in trustee securities. The following table shows the progress of the company :—

	Equiv. of 8-c.p. lamps.	Profit.
1909	180,909	£20,859
1910	189,885	22,002
1911	199,156	23,557
1912	211,338	24,436

The number of consumers is now 3,771, and, with the exception of 31, they are supplied at 200 volts. The gross revenue for the year was £44,780, an increase of £1,721. From the available net profit of £25,055, there have to be deducted the following :—Depreciation, renewal and reserve fund, £3,000 ; debenture and other interest, £2,424 ; Kensington and Notting Hill joint debenture stock—interest, £2,439 ; sinking funds, £1,473 ; to be distributed to staff under co-partnership scheme, £286 ; leaving a balance available for dividend of £15,433. Both classes of 6 per cent. preference shares have already received their full dividend, which absorbs £8,136, and leaves a balance of £7,297 available for dividend on the ordinary shares. The directors, therefore, recommend the payment of a dividend of 5s. per share, less tax on the ordinary shares, absorbing £6,368. The balance carried forward is £929, compared with £619 in 1911. The scheme of co-partnership with the company's staff, foreshadowed by the chairman at the last general meeting, was brought into operation during the year. Under this scheme, as shown above, £286 will be distributed to the staff, being an addition of 8 per cent. to their wages.

Units generated and purchased	3,341.191
Units sold—Public lamps	103,958
Private consumers by meter	2,378,456
Total sold	2,482,414
Units used on works	26,922
Total accounted for	2,509,336
Expended in distribution transformers and accumulators ..	831,855
Public lamps	53
Total maximum supply demanded	1,631 KW.

Newcastle and District Electric Lighting Co., Ltd.

THE directors' report for the year ending December 31st, 1912, states that the number of units sold was 14,789,149 as against 13,599,294 sold in 1911, being an increase of 8·75 per cent. The result of the year's working was—Gross profit of £27,933, plus £9,898 brought forward, making £37,831, less interest on 4½ per cent. first debenture stock, 6 per cent. second mortgage debentures, temporary loans, &c., £14,965 ; directors', trustees', and auditors' fees, income-tax, leasehold redemption fund, &c., £1,471 ; leaving £21,395, less interim dividend paid August 16th, 1912, £4,199 ; leaving an available balance of £17,195. Out of this there is to be paid a dividend at the rate of 3 per cent. per annum (less income-tax) for the half-year ended December 31st last (making, with the interim dividend paid in August, 3 per cent. for the year), £4,200 ; £1,900 is to be transferred to second mortgage debenture redemption fund ; writing off second debenture issue expenses absorbs £400, transfer to reserve fund £2,000, and £8,695 is to be carried forward. The profits for the year have been affected by the National Coal Miners' strike and other labour troubles, but notwithstanding this the gross receipts have increased. Contracts for the supply of coal over the whole of the present year were made before the great rise in the price took place, and the directors do not anticipate that the total expenditure per unit under this head will be greater than for 1912. Work is proceeding in connection with the Newburn Tramways, and they will be open for traffic in May. The company under an agreement made with the Corporation of Newcastle-upon-Tyne will supply all the electrical energy required for working the cars for a period of ten years. At the end of that time negotiations may be entered into for renewing the contract. In the early part of last year £150,000 6 per cent. second mortgage debentures were offered to the public, and practically the whole of this amount was taken up ; £2,000 of these debentures have been redeemed. The whole of the property owned by the company, including plant, machinery, mains, &c., has been maintained in a high state of efficiency out of revenue during the year. Reference is made to the death of Mr. James Patterson, who had been secretary of the company since its inception. The meeting is to be held to-day (Friday).

STOCKS AND SHARES.

Tuesday Evening.

THE Stock Exchange markets have been steeped in gloom and depression. At the root of the troubles lies the tightness of money—due in no small degree to the prosperity of the country, so that we are presented with the anomaly of excellent trade playing havoc with securities of all kinds in the stock markets. Amongst the issues with which we deal, the most noticeable are those in the Mexican group, substantial falls having taken place in nearly everything connected with that country. The shares and bonds of the utility undertakings in Mexico have been affected even more than the rest.

The slump lowered Mexican Light and Power descriptions very materially, the Company's first mortgage bonds shed no less than 5 points, while the seconds dropped about as much to 81½. The Common stock is 3 down on the week, and the Preferred 4½. The great fear, of course, is lest the revolutionaries—or the Federals, for that matter—may blow up the Company's stations, either by design or accident. The street fighting is also responsible for a fall of 4 points in Mexico Tramway Common shares, this Company's bonds of both classes being down about 3 points each. These movements, of course, follow upon earlier falls, and the decline since the beginning of the year is now assuming serious proportions.

Going back a couple of months, it may be recalled that Mexico Trams stood at 110, against the present price of 106½. Mexican Light and Power Common were 84½, and now are 79, the first Mortgage bonds being 96 against the current quotation of 90½. The flatness has spread to Monterey Fives, which are down 3 ; while Pachuca bonds are dull at 91½—the latter guaranteed, of course, by the Mexican Light and Power Company. The various trust and financial undertakings which in normal times can be depended upon to support the market by taking bonds such as those of the Mexican utility companies are holding their hand in view of the state of the country ; and individual holders, more or less alarmed by the outlook, have been persistent sellers during the past two or three weeks. No doubt the sanest view to take is that the revolution is bound to come to an end before long, and that as the utility companies have excellent businesses, their re-establishment will naturally follow, so that the position of the first mortgage bondholders should be tolerably secure. But it is not surprising that the proprietors of the junior stocks should feel uncomfortable, and it is to be devoutly hoped that the turmoil will be appeased as rapidly as permanently.

Other Latin-Canadian shares and bonds have suffered in sympathy with the Mexican slump. Shawinigan Water, and Montreal Light, Heat and Power, for instance, are as much as 6 and 7 points down respectively. Kaministiquia bonds are ½ lower. Rio Trams First Mortgage and Sao Paulo Trams First Debenture have given way 1 and ½ respectively. British Columbia Railway issues are weaker. Brazil Traction Ordinary lost 1½ on top of their fall last week.

Notwithstanding this welter of weakness, a few exceptions stand out which redeem the list from being entirely one way. For instance, Winnipeg 4½ per cent. Debenture is ½ higher ; Perth Debenture improved to the same extent ; West Kootenay Sixes are 1 up. The improvements, however, certainly require a good deal of searching for, the market, as a whole, being very unstable.

English Electricity Supply shares are upheld by the declarations of their dividends, and the City of London announcement, with its bonus on the Ordinary shares, caused the price to gain another 10s., bringing it up to 18¼. Kensington are better at 8 middle, and there has been some inquiry for certain of the Preference shares, in the course of which Metropolitan Preference and St. James' Preference both gained fractions. The market, as a whole, is steady, without much interest being displayed by the public ; and not even the fogs of last week caused so much as a ripple of bullishness amongst the price list.

Home Rails have been flat ; from North-Westerns to East Londons the dismal tale was repeated day by day, the foreign outlook and the tightness of money combining to make these stocks a target for bear attacks at the same time that the tired bulls were closing their commitments. The Undergrounds have suffered with the rest. The Central London trio, *ex* dividend, show comparatively small falls, but City and South London Preferences, also *ex* their 2½ per cent. dividends, were marked down 5, showing a drop of 2½ on balance. Metropolitans have fallen sharply, but Great Northern and City Preferred Ordinary braced up to 2⅛ on the ratification of the agreement by the Metropolitan to take over the line. Districts went back below 40, and there has been a sharp drop in Underground Electric Railways Ordinary shares, while the company's 1s. shares also gave way. These falls were associated with the issue of the report, which, as we were remarking last week, was considered rather disappointing. It seems to show that the payment of dividends on the Ordinary and the "A" shares is still some way off ; and holders who have been looking for news as to a probable distribution in the near future are inclined to wonder whether this will be made as soon as they had expected.

The Telegraph market is amongst the few to resist the flat tendency noticeable elsewhere. Rises have taken place in Anglo-American Ordinary, Commercial Cable Debenture, Eastern Telegraph Ordinary, Eastern Extension Debenture, Globe Ordinary, Great Northerns, and Western Telegraph Debenture—a highly satisfactory list, having regard to the weakness in the rest of the markets. Amongst the few declines which have taken place, there is one of $\frac{1}{16}$ in West India and Panama, which, of course, are held by a speculative division ; while Direct Spanish Preference eased off to 6½. The Telegraph market is steady, without special feature. As the books of the National Telephone close finally on the 25th inst., dealings are now transacted either for cash or for settlement when the ultimate award is made ; and, obviously, there is not much temptation to gamble in the stock in these circumstances.

The Manufacturing group has been distinguished by a rise of three-eighths in British Insulated and Helsby Cable shares, which carried the price to 8⅜ middle. The greater part of this improvement, however, was subsequently lost. Telegraph Constructions are £1 better, and the rest of the shares in this group are quietly firm.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Feb. 18th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord. ..	10	5½	5†	9⅞ — 10⅛	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8½ — 9 xd	..	4 14 9
Do. Second 6 % Pref. ..	10	6	6	9¾ — 10¼ xd	..	5 17 1
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord...	5	10	9†	8⅞ — 9⅜	..	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8½ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅝ — 5⅛	..	4 17 7
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4½ xd	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅜	..	5 2 10
Do. Do. 4 % Deb... ..	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 15 3
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	6†	17½ — 19	+ ½	4 4 3
Do. 6 % Cum. Pref.	10	6	6	12⅛ — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb. ..	100	4½	4½	100 —102	..	4 8 3
County of London, Ord... ..	10	6	4†	11⅛ — 12	..	5 0 0
Do. 6 % Pref.	10	6	6	11⅜ — 12⅛	..	4 19 9
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 4 11
Do. 4½ % Second Deb. ..	Stock	4½	4½	98 —101	..	4 8 8
Edmundson's, Ord.	£3	Nil	..	⅝ — ¾	..	Nil
Do. 6 % Cum. Pref.	5	Nil	3	4⅛ — 4⅜	..	..
Do. 6% Non-Cum. Pref. ..	5	..	..	1⅜ — 1⅝	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	82 — 85	..	5 5 11
Folkestone	5	6	6	4⅜ — 5⅛	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5⅛	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92	..	4 17 10
Hove	5	9	8†	7⅞ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	5	9	8†	7⅞ — 8⅛	+ ⅛	5 9 1
Do. 4 % Deb.	Stock	4	4	90 — 93	..	4 6 0
Kent Elec. Power, 4½ % Deb. ..	Stock	4½	4½	76 — 80	..	5 12 6
London Electric, Ord.	3	2½	..	1⅛ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	5 — 5⅝	..	5 11 7
Do. 4 % First Mort. Deb. ..	Stock	4	4	89 — 92	..	4 7 0
Metropolitan	5	4	4†	3½ — 4	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅝	+ ⅛	4 17 4
Do. 4½ % First Mort. Deb. ..	Stock	4½	4½	97 —100	..	4 10 0
Do. 3½ % Mort. Deb... ..	Stock	3½	3½	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 — 101	..	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ —102½	..	4 17 7
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9⅛ — 9⅝	..	5 3 11
Do. 7 % Pref.	5	7	7	7 — 7⅛	+ ⅛	4 13 4
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord. ..	5	2	2	⅝ — 1⅛ xd	..	..
South London, Ord.	4	5	..	2¾ — 3¼	..	6 3 1
Do. 5 % First Mort. Deb. ..	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref...	1	7	7	1⅛ — 1½	..	5 12 0
Do. 4½ % First Deb. Stock ..	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord...	£3	Nil	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	2	‡	2⅝ — 3⅜	..	..
Do. 4½ % First Mort. Deb. ..	100	4½	4½	84½ — 87½	— ½	5 2 10
Westminster, Ord.	5	10	9†	8⅞ — 9⅛	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	4⅞ — 5¼	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅞ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92 — 94	..	5 6 5
Canadian Gen. El. Com. ..	$100	7	7	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 18 0
Cordoba Lt., Power and T., Ord.	1	8	5	13/16 — 15/16	..	5 6 8
Do. 5 % Deb.	100	5	5	96 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	1/16 — 1/8	..	Nil
Do. 6 % Pref.	1	6	6	9/16 — 5/8	..	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	101½ —103½	— ½	4 16 7
Madras, Ord.	5	Nil	..	1⅜ — 1⅝	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	79 — 83	—4½	6 0 6
Mexican Lt. & Power, Common	$100	4	4†	77 — 81	—3	4 18 9
Do. 7 % Cum. Pref.	$100	7	7	100 —105	—4½	6 13 4
Do. 5 % 1st Mort. Gold Bds.	..	5	5	89 — 92	—5	5 8 8
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	83 — 85	—3	5 17 8
Montreal, Lt., H. and Power ..	$100	8	9†	283 —283	—7	3 15 8
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8 0
Do. 6 % Non-Cum. Pref. ..	Do.	6	6	104 —109	—2	5 10 1
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital ..	$100	5	5	138 —142	—6	3 10 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	106 —108	..	4 12 7
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	..	4 7 10
Toronto Power, 4½ % Deb. ..	Do.	4½	4½	98½ —100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref. ..	1	11 3/4d.	17 1/2d.	7/8 — 15/16	—1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	106 —108	+1	5 11 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4½†	7 — 7½	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97½ — 99½	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	135 —137	+ ½	5 16 10
Do. Collat. Trust	$1000	4	4	91 — 93	..	4 6 0
Anglo-American Telegraph ..	Stock	3	3	65 — 68	+ ½	4 8 8
Do. 6 % Pref.	Do.	6	6	110¼ —111½	..	5 7 7
Do. Def.	Do.	80/-	..	24⅜ — 24⅝	..	6 1 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅝ — 7⅞	+ ⅛	5 1 7
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	79 — 81	+1	4 18 9
Cuba Telegraph	10	6	6†	8¼ — 9¼	..	6 9 9
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6¼ — 6⅝	— ⅛	7 8 2
Direct United States Cable ..	10	5	4	6⅝ — 7⅜	..	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	133 —136	+ 1	5 3 0
Do. 8½ % Pref. Stock.. ..	Do.	8½	8½	78 — 80	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	13 — 13½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	95½ — 97½	+ ½	4 2 1
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust ..	10	6	6†	10½ — 11	+ ⅛	5 9 1
Do. 6 % Pref.	10	6	6	12⅜ — 12⅝	..	4 18 2
Great Northern Telegraph ..	10	18	18	29 — 31	+ ½	5 14 3
Indo-European Telegraph ..	25	13	5†	57 — 59	..	5 10 2
Mackay Companies Common ..	$100	5	5	85 — 89	..	5 12 4
Do. 4 % Cum. Pref.	$100	4	4	68 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	20	..	4⅜ — 4½	—1/16	4 8 11
Do. 7 % Cum. Partic. Pref.	1	17	..	3¾ — 4	..	4 5 0
Monte Video Telephone, Ord. ..	1	6	6†	1 3/16 — 1 5/16	..	5 18 0
Do. 5 % Pref.	1	5	5	3/4 — 7/8	..	5 14 8
National Telephone Def. ..	Stock	6	..	90 — 95	..	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	98½ — 99½	..	4 10 8
Oriental Telep. and Elec. ..	1	8	6†	1 3/16 — 1 5/16	— 3/32	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	88 — 90	..	4 8 11
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	..	4 0 5
Reuter's	10	10	10†	11¼ — 11¾	..	8 10 2
Submarine Cables Trust ..	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	96 — 98	— 1	4 11 10
United River Plate Telephone	5	8	..	7⅛ — 7⅜	+ 1/16	5 3 3
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	..	1 5/16 — 1 7/16	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3½ — 3⅝	— 1/16	..
Do. 6 % Cum. 1st Pref. ..	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref. ..	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd. ..	10	7	7†	18½ — 18⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	95 — 97	+ 1	4 2 6
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ —100½	..	4 10 0

*Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs.

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 18th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅜ — ⅝	..	Nil
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref.	100	..	..	10½ — 12½	..	..
Do. Do. Deferred	100	..	..	4½ — 6½	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	86½ — 89½	..	6 14 1
Do. 7 % Non-Cum. Pr'f.	100	..	..	26½ — 30½	..	..
Do. 5 % Perp. Deb.	100	5	5	91 — 95	..	5 5 3
Do. 4½ % 2nd Deb.	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	8	8	78 — 80 xd	−1½	8 15 0
Do. Pref.	100	4	4	82 — 84 xd	..	4 15 3
Do. Def.	100	2	2	77 — 79	−2	2 10 8
Do. 4 % Deb.	100	4	4	98 — 100	..	4 0 0
City & South London, Ord.	100	1⅝	..	..	..	3 11 5
Do. 5 % Pref., 1891	100	5	5	102 — 104 xd	−2½	4 16 2
Do. Do. 1896	100	5	5	102 — 104 xd	−2½	4 16 2
Do. Do. 1901	100	5	5	102 — 104 xd	−2½	4 16 2
Do. Do. 1908	100	5	5	102 — 104 xd	−2½	4 16 2
Do. 4 % Deb.	100	4	4	97 — 99	..	4 0 10
Dublin United Trams, 6 % Pref.	10	6	6	11⅜ — 12½ xd	..	4 18 0
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2⅛ — 2⅜	+ ⅛	Nil
Hastings Trams, 6 % Pref.	1	6	6†	⅞ — 1	..	7 7 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
sle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2⅝	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	94 — 96	−1	4 3 4
London United Trams, 6 % Pref.	10	Nil	..	4⅛ — 5⅛	..	..
Do. 4 % Deb.	100	4	4	69 — 72	..	5 11 1

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 18th.	Rise + or Fall —	Present Yield p.c.
	*	1911.	1912.			£ s. d.
Metropolitan Railway Consol.	100	1⅞	1⅞	51¾ — 52¼	−1¾	3 2 2
Do. Surplus Lands	100	2⅛	2⅛†	61 — 63	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	85 — 87	−1	4 0 6
Do. 3½ % Pref.	100	3½	3½	82 — 84	−1	4 3 4
Do. 3½ % Con. Pref.	100	3½	3½	83 — 85	..	4 2 4
Metropolitan District Ord.	100	Nil	Nil	33½ — 40	−1	Nil
Do. 6 % Deb.	100	6	6	139 — 141	..	4 4 0
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 — 101	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	87 — 89 xd	..	5 1 2
Do. 3½ % Gtd.	100	3½	3½	75 — 77	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	6	5†	1⅝ — 1¾	..	5 18 6
Do. 5 % Pref.	1	5	5	3 — 3⅛ xd	..	5 14 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	3½	..	⅞ — 1	..	..
Do. 5 % Pref.	1	5	5	1⅛ — 1⅜ xd	..	3 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 8
South Metro. Trams, 6 % Pref.	1	6	..	⅛ — ⅜	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4⅛ — 4⅜	— ⅛	Nil
Do. "A"	1/-	..	..	⅛ — ⅜	— 1/16	..
Do. 6% First Cum. Inc. Deb.	100	..	6	111½ — 113½	..	5 5 9
Do. 4½ % Bonds	100	4½	4½	98 — 100	..	4 10 0
Do. 6 % Income	100	1½	6 †	93¼ — 94½	−1½	..
Yorkshire (West Riding), Ord.	5	Nil	..	⅛ — ¼	..	Nil
Do. 6 % Pref.	5	3	3†	2⅞ — 3⅛	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7 2

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5⅜	5⅜	4⅝ — 4⅞	..	5 14 8
Do. 4 % Deb.	100	4	4	93½ — 94½	−1	4 4 8
Do. 4½ % Deb.	100	4½	4½	99 — 101	..	4 9 1
Do. 5 % Deb.	100	5	5	98½ — 100½	..	4 19 6
Auckland Trams, 5 % Deb.	100	5	5	101 — 103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 12	..	5 0 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	6†	97⅛ — 99½	−1½	..
Brisbane Trams Invt., Ord.	5	8	8†	7⅛ — 7⅝	+ ⅛	5 5 0
Do. 5 % Pref.	5	5	5	4⅝ — 5¼	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 — 103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	..	139 — 143	−1	5 12 0
Do. Pref. Ord.	100	6	6	119 — 123	−1	4 17 7
Do. 5 % Pref.	100	5	5	105 — 108	+1	4 12 7
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 — 103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	101 — 103	..	4 7 5
Do. 4½ % Con. Deb.	100	4½	4½	96½ — 98½	−1	4 6 4
Calcutta Trams, Ord.	5	7	5†	5⅞ — 6¼	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅛ — 5⅞	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 — 100	..	4 10 0
Cape Electric Trams	1	2½	..	⅞ — 1	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅛ — 5⅜	..	4 6 11
Do. 4 % Deb.	100	5	5	97 — 100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 97	..	5 3 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	99 — 103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	⅛ — ⅜	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	8	30 — 40	..	..
La Plata Elec. Trms, Ord.	1	Nil	..	⅛ — ⅜	..	..
Do. Pref.	1	6	..	1 — 1⅛	..	6 0 0
Lisbon Elec. Trams, Ord.	1	6	6†	1⅛ — 1⅜	+ ⅛	4 7 3
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 5 3
Madras Elec. Tr. (1904), Deb.	100	5	5	101 — 103	..	4 17 1
Manaos Trams & Lt., 1st Deb.	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	98 — 100 xd	..	5 0 0
Mexico Trams Com.	$100	7	7†	105 — 108	−4	6 9 8
Do. Gen. Con. 5 % Bonds	..	5	5	91 — 94	−3½	5 6 5
Do. 6 % Bonds	100	6	6	97 — 100	−2½	6 0 0
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7⅜ — 7⅞	— ⅛	6 7 0
Do. 6 % Pref.	5	6	6	4¾ — 5⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 — 101	+ ½	4 19 0
Perth (W.A.) Elec. Tr., Ord.	1	5	5½	1⅜ — 1½	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 — 108	..	4 12 7
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 — 103	— ½	4 17 1
Do. 5 % Mort. Bonds	100	5	5	96 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	103½ — 105½	— ½	4 14 9
Singapore Trams, 5 % Deb.	100	5	5	86 — 90	..	5 11 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	97 — 99	..	5 1 0
Un. Elec. Trams Monte Video	5	7	6†	5¾ — 5⅞	..	6 1 9
Do. 6 % Pref.	5	6	6	4¾ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 — 102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	100½ — 103½	+ ½	4 7 0

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	¾ — 1	..	8 0 0
Do. 6 % Pref.	1	6	6	3⅝ — 3⅞	+ ⅛	7 2 2
Babcock & Wilcox	1	28	14†	34 — 35	— 1/16	4 0 0
Do. Pref.	1	6	6	1¼ — 1⅜	..	4 0 0
British Aluminium, Ord.	1	Nil	..	⅞ — 1	..	..
Do. 6 % Cum. Pref.	1	Nil	..	⅞ — 1	..	..
Do. 5 % Prior Lien Debs.	100	5	5	91 — 94	..	5 6 5
Do. Deb. Stk.	100	5	5	87 — 90	..	5 11 1
B.I. & Helsby Cables	5	10	8†	8¼ — 8⅝	+ ⅛	5 15 11
Do. Pref.	5	6	6	5⅞ — 6¼	..	4 16 0
Do. Deb.	100	4½	4½	102 — 104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	26½ — 28½	..	4 11 5
British Westinghouse, Pref.	8	Nil	Nil	⅜ — ½	..	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 — 103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	2/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — ½	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	40 — 45	..	10 0 0
Do. 4½ % Second Deb.	100	4½	4½	28 — 32	..	14 1 4
Callender's Cable	5	15	10†	11 — 11⅜	..	6 7 8
Do. Pref.	5	5	5	4⅞ — 5¼	..	4 17 7
Do. Deb.	100	4½	4½	97 — 100	..	4 10 0
Casmer-Kellner	1	20	20	8½ — 8⅝	..	5 5 0
Do. Deb.	100	4½	4½	103 — 106	..	4 4 11
Crompton & Co.	8	Nil	..	⅛ — ⅜	..	Nil
Do. Deb.	100	5	5	55 — 57	..	9 15 6
Dick, Kerr	1	5	Nil	2⅜ — 2⅝	..	..
Do. Pref.	1	6	6	3⅛ — 3⅜	..	6 17 2
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £8 paid	5	Nil	..	0 — ¼	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	61 — 65	..	6 3 1
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3½	1¾ — 1⅞	..	5 14 4
Do. Pref.	2	7	7	1⅝ — 2	..	7 0 0
Greenwood & Batley, Pref.	10	7	7	7⅞ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	9⅜ — 10⅜	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 8
Henley's, Ord.	5	17	5†	13 — 13½	..	6 8 8
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 — 103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9⅜ — 10⅛	..	4 17
Telegraph Construction	12	17½	5†	86 — 88	+1	5 16 8
Do. Deb.	100	4	4	95½ — 96½	..	4 1 3
Willans & Robinson	1	Nil	..	⅛ — ⅜	..	Nil
Do. Pref.	5	Nil	..	⅜ — ⅝	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Bank rate of Discount 5 per cent., October 17th, 1912.

GERMAN EXPORTS OF ELECTRICAL GOODS IN 1912.

THE following figures showing the exports of electrical goods from Germany in 1912, are taken from the recently issued official trade statistics; figures for 1911 are added for purposes of comparison, and notes of any increases or decreases are given. The total exports of all kinds of electrical goods in 1912 were 114,546,700 kilogs. valued at 233,496,000 marks, as against 107,630,500 kilogs. valued at 208,017,000 marks in 1911 :—

	1911. Kilogs.	1912. Kilogs.	*Inc. or dec.* Kilogs.
Dynamos, electric motors, transformers, &c., up to 25 kg. weight.—			
To Austria	88,000	116,000	+ 28,000
„ Russia	56,000	84,000	+ 28,000
„ France	34,000	50,000	+ 16,000
„ Great Britain	39,000	48,000	+ 9,000
„ Other countries ...	222,000	277,000	+ 55,000
Total ...	439,000	575,000	+ 136,000
Ditto, from 25 kg. to 100 kg.—			
To Austria	499,000	672,000	+ 173,000
„ Russia	223,000	268,000	+ 45,000
„ Great Britain	104,000	212,000	+ 108,000
„ Belgium	126,000	193,000	+ 67,000
„ France	157,000	189,000	+ 32,000
„ Italy	249,000	193,000	— 56,000
„ Holland	111,000	197,000	+ 86,000
„ Other countries ...	792,000	927,000	+ 135,000
Total ...	2,261,000	2,851,000	+ 590,000
Ditto, from 100 to 500 kg.—			
To Austria	768,000	895,000	+ 127,000
„ Russia	502,000	622,000	+ 120,000
„ Belgium	497,000	577,000	+ 80,000
„ Great Britain	345,000	503,000	+ 158,000
„ Brazil	291,000	491,000	+ 200,000
„ Spain	275,000	433,000	+ 158,000
„ Italy	539,000	454,000	— 85,000
„ Argentina	279,000	330,000	+ 51,000
„ Other countries ...	2,315,000	2,536,000	+ 221,000
Total ...	5,811,000	6,841,000	+1,030,000
Ditto, over 500 kg.—			
To Japan	3,613,000	2,960,000	— 653,000
„ Italy	2,349,000	2,550,000	+ 201,000
„ Argentina	1,631,000	2,589,000	+ 958,000
„ Belgium	1,341,000	1,892,000	+ 551,000
„ Russia	1,248,000	1,421,000	+ 173,000
„ Spain	1,128,000	1,686,000	+ 558,000
„ British S. Africa ...	2,479,000	1,328,000	—1,151,000
„ Brazil	857,000	1,078,000	+ 221,000
„ Other countries ...	9,554,000	8,559,000	— 995,000
Total ...	24,200,000	24,063,000	— 137,000
Cables.—			
To Belgium	3,427,000	4,382,000	+ 955,000
„ Holland	4,446,000	5,721,000	+1,275,000
„ Sweden	4,475,000	3,033,000	—1,442,000
„ Japan	4,714,000	4,489,000	— 225,000
„ Argentina	4,095,000	3,514,000	— 581,000
„ Norway	1,339,000	1,570,000	+ 231,000
„ Great Britain	1,133,000	1,220,000	+ 87,000
„ Other countries ...	18,704,000	14,041,000	—4,663,000
Total ...	42,333,000	37,970,000	—4,363,000
Electric arc lamps.—			
To Russia	90,000	91,000	+ 1,000
„ Austria	64,000	66,000	+ 2,000
„ Great Britain ...	71,000	71,000	—
„ Argentina	68,000	66,000	— 2,000
„ Other countries ...	352,000	263,000	— 89,000
Total ...	645,000	557,000	— 88,000
Metal-filament lamps.—			
To Russia		370,000	—
„ Great Britain	Details	260,000	—
„ Spain	not	136,000	—
„ Italy	available.	152,000	—
„ Austria		190,000	—
„ France		113,000	—
„ Other countries ...		850,000	—
Total ...		2,071,000	—
Galvanic batteries.—			
To Great Britain	214,000	293,000	+ 79,000
„ Holland	84,000	116,000	+ 32,000
„ Sweden	89,000	166,000	+ 77,000
„ Switzerland	75,000	99,000	+ 24,000
„ Other countries ...	471,000	516,000	+ 45,000
Total ...	933,000	1,190,000	+ 257,000

	1911. Kilogs.	1912. Kilogs.	*Inc. or dec.* Kilogs.
Electric apparatus for lighting, power, &c.—			
To Russia	1,332,000	1,790,000	+ 458,000
„ Austria	1,021,000	1,627,000	+ 606,000
„ Italy	951,000	1,263,000	+ 312,000
„ Belgium	839,000	1,195,000	+ 356,000
„ Agentina	1,189,000	1,361,000	+ 172,000
„ Brazil	303,000	611,000	+ 308,000
„ Japan	845,000	527,000	— 318,000
„ Great Britain	589,000	815,000	+ 226,000
„ Other countries ...	4,597,000	6,128,000	+1,531,000
Total ...	11,666,000	15,317,000	+ 3,651,000
Electric meters, &c.—			
To Austria	328,000	406,000	+ 78,000
„ Russia	301,000	397,000	+ 96,000
„ Italy	221,000	361,000	+ 140,000
„ Argentina	139,000	163,000	+ 24,000
„ Japan	65,000	101,000	+ 36,000
„ Spain	55,000	147,000	+ 92,000
„ Belgium	83,000	118,000	+ 35,000
„ Denmark	76,000	103,000	+ 27,000
„ Other countries ...	684,000	761,000	+ 77,000
Total ...	1,952,000	2,557,000	+ 605,000
Insulating tubes.—			
To Belgium		306,000	—
„ Switzerland	Details	866,000	—
„ Russia	not	354,000	—
„ Sweden	available	286,000	—
„ Austria		274,000	—
„ Other countries ...		1,079,000	
Total ...		3,165,000	—
Electric signalling apparatus, &c.—			
To Russia		140,000	—
„ Great Britain	Details	122,000	—
„ Belgium	not	94,000	—
„ Denmark	available	63,000	—
„ Holland		59,000	—
„ Other countries ...		408,000	
Total ...		886,000	—
Telephones and telephone apparatus.—			
To Russia		134,000	—
„ Great Britain	Details	89,000	—
„ Italy	not	85,000	—
„ Austria	available	53,000	—
„ France		41,000	—
„ Other countries ...		403,000	
Total ...		805,000	—
Finished armatures and commutators.—			
To Austria	434,000	597,000	+ 163,000
„ Italy	621,000	511,000	— 110,000
„ Belgium	371,000	429,000	+ 58,000
„ France	287,000	202,000	— 85,000
„ Great Britain	300,000	430,000	+ 130,000
„ Russia	289,000	270,000	— 19,000
„ Japan	626,000	246,000	— 380,000
„ Argentina	341,000	191,000	— 150,000
„ British S. Africa ...	222,000	130,000	— 92,000
„ Other countries ...	1,573,000	1,030,000	— 543,000
Total ...	5,064,000	4,036,000	—1,028,000
Accumulators.—			
To Denmark	1,245,000	1,101,000	— 144,000
„ Sweden	1,137,000	1,953,000	+ 816,000
„ Holland	373,000	444,000	+ 71,000
„ Norway	101,000	290,000	+ 189,000
„ Japan	898,000	293,000	— 605,000
„ Argentina	902,000	3,081,000	+2,179,000
„ Chile	101,000	699,000	+ 598,000
„ Other countries ...	1,619,000	1,209,000	— 410,000
Total ...	6,376,000	9,070,000	+2,694,000

Kilog. = 2·204 lb.

The Electrical Production of Ferro-Silicon and Potash.—It is reported from Gothenburg that a Swedish engineer (Axel Lindblad), who is known through his work in connection with the electric smelting of iron, is experimenting with a trial plant in which felspar, which contains up to 18 per cent. of potash, is electrically smelted with coal and iron. The main product resulting is ferro-silicon, whilst easily soluble potash salts are in the slag. A quantity of 100 tons of fertilising potash is said to have been made already with the experimental plant, and it is now proposed to erect a large installation. It is stated that the economic question of manufacturing will depend upon whether it will be possible to find a market for the large tonnage of ferro-silicon which must be produced, without depressing the price of this alloy.

THE USE OF ELECTRICITY AND ELECTRICAL ACCIDENTS IN MINES.

(*Continued from page* 253.)

A FOURTH accident, which occurred at Auchengeich Colliery, and caused the death of a miner, was also due to a fault in the earthing system. The current, which was three-phase at 440 volts, was used for coal-cutting purposes. The main and trailing cables were armoured and the earthing was intended to be effected by means of the armouring connected to an earth plate at the surface, but it transpired afterwards that owing to a mistake on the part of a workman, and a lack of supervision on the part of the officials, no efficient earthing system existed. A fault developed at a joint in one of the cables, and, in consequence, the armouring became alive. Deceased, who was pushing a loaded tub, came in contact with it and was killed.

On investigating the accident, it was difficult at first to discover why the earthing system did not carry away the leakage, and thus prevent an accident. It was, however, afterwards found that a workman when cutting a drain had come across a wire or cable, and as it crossed the path of the drain he cut it with his shovel. This cable was the earth wire for the whole system at the colliery: after it was cut the safeguard of earthing ceased to exist, and this accident was the result.

We have mentioned on other occasions the tendency to practical joking with electricity amongst the employés at collieries, but one would scarcely think it possible for anyone to go to such a length as the victim of the following accident, who, as the Inspector says, "paid the penalty of his folly with his life." The accident took place at Polton Colliery, and caused the death of an engineer's labourer on the surface while he was attempting to make a connection between the cables of a lighting circuit and a lathe in the fitting shop, in order that the man working it should, on the following day, receive a shock. It appears that deceased went into a loft about 10½ ft. above the lathe at the close of the day's work, where he was unseen, and he was not missed. Inquiries were made about him the next morning, and his body was found by the engineer lying on the floor face downwards, with his head close to the edge of the loft overlooking the workshop, but partly hidden by some belt pulleys. The engineer touched him and received an electric shock, and therefore had the current cut off. The deceased's right arm and the left side of his face were severely burned; his right arm had made contact with a live zinc plate and his face with an iron bracket connected to a girder and thus to earth. He was quite cold, and had apparently been killed outright on the previous night. His intention clearly appears to have been to make a connection between a live lighting wire and a bracket carrying the belt pulleys, so that the man who worked the lathe and oiled the machinery would get a shock when at work next day. It is almost inconceivable that a workman should be so foolish, and no doubt had this man not been killed, the intended victim of the practical joke might have been seriously if not fatally injured. As we have said, this is not a solitary instance of this sort of thing, and the Inspector further goes on to say: "Recently it has come to my knowledge that a man employed at a coal-cutting machine underground had been giving men shocks by switching the current on at the gate box, and then placing the trailing cable in contact with the frame of the machine, and thus causing men working near it to receive a shock. Fortunately, no one was hurt. The special rules do not provide for the punishment of offences of this kind, and it was not possible to do anything except dismiss the man in question from his employment at the colliery."

The following are briefly details of the non-fatal accidents which occurred in this district:—

1. A brusher was sent out from the face to bring in a trailing cable from a gate-end box to a coal-cutter, and instead of taking it in and returning to switch on the current, he, in order to save himself the trouble of the double journey, switched it on at the gate-end box, and was carrying the live cable in. The terminals came in contact with the pavement, and the resulting flash burned his hand. He was lucky to escape with such slight injuries, as he might have been fatally injured. It is difficult to understand why men will be so foolhardy. The only reasonable explanation is that they do not realise the serious risk they run by such recklessness. "Such work as bringing in trailing cables should only be done by the *machinemen themselves*, as they have, or *should have some knowledge of the danger of electricity*, and would not, I trust, be guilty of such conduct."

2. A coal-cutter driver received a severe shock from a coal cutter driven by D.C. at 500 volts, with concentric cable and earthed outer. The circuit breaker on the surface was thrown out by an overload on the coal-cutter, and when the machine stopped, he leaned forward to switch off and received the shock. An examination of the machine afterwards showed that the *negative connection was 2½ turns slack and loose*. This was tightened up, and there was no trouble afterwards. The cause of the shock was, no doubt, this bad negative connection. Mr. Masterton, one of the junior inspectors, in investigating the accident, found that the negative connection between the gate-end box and cable was *unsatisfactory*.

3. A pumper was putting in a switch which required to be put in smartly, but he put it in slowly, with the result that an arc was formed, which burned the back of his hand. The current was A.C. at 500 volts. *He had no duty in the switch room and should not have touched the switch.*

4. A coal-cutter chargeman was burned on the back of his neck, owing to the machine becoming charged, and an earth connection not having been made by the injured man. The gate-end box was earthed to a water pipe, and the coal-cutter to the box by an additional wire in the trailing cable attached to the box by a lug and screws, and he failed to attach this wire. The leads ran along the bottom to the opposite side of the coal-cutter, and as they were liable to be damaged, the manager had them put into an iron pipe, and this necessitated a large hole being made into the controller box. This hole *had not been bushed*, and the vibration of the machine caused the edge of it to cut through the insulation of the leads, resulting in a short. It is fortunate that the neglect to bush the hole properly did not result in fatal injuries. The defect was at once remedied, and *it will be a lesson to everyone concerned not to overlook such a necessary precaution in future.*

5. A coal-cutter machineman received a shock owing to a small spring of a switch breaking and allowing the live tongue of the switch to come in contact with the casing of the machine and make it "live." The machine was not earthed, and the current was at once switched off. The injured man was unconscious, and it was not until artificial respiration had been kept up for three-quarters of an hour that he regained consciousness. The current was A.C. at 400 volts; at the time of the accident preparations were being made to earth the frames of the machines to the surface, and the neutral point of the system has also been earthed. It is a miracle that this man was not killed, and but for the praiseworthy manner in which the men at hand kept up artificial respiration he would have died. The accident shows the necessity of efficiently earthing the frames of all apparatus, and, further, of maintaining artificial respiration for a long period in cases of supposed death from electric shock.

6. An assistant electrician on looking at an underground motor noticed that the brushes were sparking slightly, and, in order to remedy this, he turned the rocking gear, but pushed it too far, and the flash thus caused burned the back of his hand.

"A non-fatal accident injuring a motor attendant also occurred on the surface. The motor driving the screening plant had been changed over from a direct-current one at 500 volts to a three-phase at 3,000 volts, a week before the accident occurred. The D.C. switchboard was allowed to remain, and it was intended to change it at the week end. The fuses were withdrawn and the switch was opened, but two live terminals on the board, 4 ft. from the floor and 2½ in. apart, were unprotected.

"The injured man was the only one who had access to the motor room, which he kept locked. He stated that he was sitting on a box in front of the board having a meal, at the end of which, as he was getting up, his sleeve caught an enamelled 'danger plate,' which projected sideways from

the board, and a flash resulted which burned the back of his hand. His story does not appear to be a very likely one, and I fear he had been placing something across the terminals, and that when facing the board a short flame burned his hand; he, however, adhered to his statement. In any case he should not have been sitting so close to a switchboard as to touch the danger plate, and I do not for a moment think he would do so with a 3,000-volt current. *Terminals should not be left exposed* in this way, and I am surprised that it should have been allowed."

An underground fire caused by the failure of the electrical plant took place at East Parkhead Colliery. The supply of electricity at this colliery is on the concentric system at 500 volts, and the installation was an old one, predating the Electricity Special Rules. The origin of the fire was traced to fusing in a four-way junction and fuse box, which was nailed to two props on the side of a haulage road about a quarter of a mile from the shaft bottom. An examination of the junction box after the occurrence showed it was a very probable cause of fire. There were clear signs of frequent arcing both on the side of the box, and inside the cover, and it is likely that an arc caused by the blowing of a fuse was formed to the side of the box, and that this was maintained until the insulation of the cable, and then the supporting timber, caught fire.

One of the cables was damaged by a fall of stone on the in-bye side of the junction box, and also on the in-bye side of a fuse, which was inserted in the cable nearer the gate-end box, just before the fire was noticed. It is probable that this fall caused the fuse in the junction box to blow. The fuse on the in-bye side of the junction box should have protected the latter, and that it failed to do so points to its having been the heavier fuse of the two. When Mr. Nelson made his inspection and investigation it was estimated to be 2/18 and, if so, was about 300 *per cent. in excess of the working current*, whereas the special rules require that it should not be more than 200 per cent. The fire in all probability would have been prevented if the fuse had not been too heavy for its circuit. This is a matter of importance, as arcing may continue for some time before causing the means provided to open the circuit to operate, as apparently happened in this case, if the means provided are slower in action than is required.

(To be continued.)

APPLICATIONS FOR SITUATIONS.

BY "WHISTLEFIELD."

ROBERT BURNS, the Scottish poet, wrote—

> "O wad some Power the giftie gie us
> To see oursels as others see us"

but if he had had to read through the numerous applications which are received in reply to jobs advertised in the ELECTRICAL REVIEW, he would probably have implored "Some Power" to give the applicants the ability to read their applications through the eyes of the wretched engineer or manager who is endeavouring to separate the good from the bad, and form a list for the purposes of an interview.

It is sometimes declared that if a man have plenty of assurance and cheek, he can get a job more easily than one who is lacking in these qualities, but does it occur to the man who knows that he is capable and has good qualifications that he may throw away all these advantages and have to yield place to another who is not so qualified, because he has relied too much on his conscious superiority, and has forgotten that the employer who is reading the applications does not know all that the applicant knows, and is forming his opinion from what is actually written, so that the man who can state his real or supposed qualifications in a convincing manner, emphasising the special qualifications which are required for the job, will stand far more chance of getting an interview than one who is careless in the arrangement and wording of his application?

The chief point which should be borne in mind by anyone who writes an application is the fact that, for every job advertised there are not only a large number of applicants, but the standard of qualifications of the applicants is invariably high, and there are always several who are quite capable of filling the post with credit; therefore it is not only necessary to show that one is capable of filling the post because of training and past experience, but the very manner in which the application is drawn up should show that, besides technical knowledge and practical experience, the candidate has common sense and is capable of appreciating what is important and what is trivial, of realising that managers are busy men who want facts and data clearly and tersely expressed.

It is little things like these which turn the scale for or against a man in a great many cases, since all employers appreciate men who have their wits about them and who think for themselves.

It is want of thought which allows a man to send in his application written on half a dozen sheets of paper, none of which are numbered, and which have not been fastened together, and very often the fault is aggravated by the fact that the testimonials are on a different kind of paper from the application, so that when they have got mixed it is not an easy matter to collect all the sheets relating to the one application, and find in what order they should be arranged.

An even worse habit, and one that is very prevalent, is to use ordinary notepaper written on every side, so that it is not only necessary to pin the sheets together when they are received, but they must be unpinned every time they are looked at. The worst cases of this kind are applications which are written on notepaper commencing on page 1, then going to page 4, then to page 2 and page 3, the same thing being repeated through three or four sheets without a single number to denote how the pages and sheets follow one another. It stands to reason that a man who is so careless and thoughtless with regard to his own concerns will not be considered a suitable person to put in any responsible position by an engineer or manager, especially when other men equally good but not so careless are available.

Another form of thoughtlessness is exhibited in the long rambling application which leaves one confused at the end, without any clear idea of what the applicant has done. An application of this kind running into a number of sheets of closely and often badly-written foolscap receives scant attention when it is one of a large pile that have to be waded through.

A moment's thought would show that when selecting a man for a post it is necessary to know his age, his present position, and the positions which he held previously. These facts could quite easily be tabulated on one page, so that at a glance it could be seen if a man was in the running or not; then on subsequent pages the information could be amplified under different headings.

The usual method of writing a continuous letter detailing the whole history of the candidate from the time he went to school to the time he made his application, leaves the reader annoyed at having to read so much to find the essential facts, and this is prejudicial to the candidate's chances.

If such information as classes attended or certificates gained seem to be essential, let them be tabulated under the heading of classes attended or certificates gained; then, if the information is not required by the man who is selecting the candidates, he can pass over that section and lose neither time nor patience. The same method could with advantage be adopted when dealing with all the data and particulars submitted, and the result will be an application in which all information required can be quickly and easily found, and which will leave a favourable impression of the applicant's method of work.

While it is not desirable that an application should be too long, it is possible to make it too brief. The following which was received in reply to an advertisement of an important post in a power station is typical of many that are sent:—

"Dear Sir, I beg to make application for the post of ——— advertised in the ELECTRICAL REVIEW of ———. I have had good experience in power station work, having held a similar post for four years; if there is any other information that you desire, or if you wish to see my testimonials, I shall be glad to call on hearing from you, yours ———."

This information might have been sufficient if the applicant had stated in what power station he had worked during those four years, or had given some indication of the plant in use; as it was, no information was given, there were plenty of other good men, and this application was thrown aside. The following extract from another application is a gem in the art of compression :—

"I have had over ten years' experience in the electrical business with contractors, manufacturers, consulting engineers and supply authorities. During this period I have been engaged on, and have been in charge of, the erection, running and repairs of motors, generators, boosters, rotary converters, switchgear, control gear, high and low-tension cable laid solid, drawn-in and armoured, the lay out of static and rotary sub-stations with gear; I am familiar with the economical running of plant and with all tests applicable to fault localisation, and have had a good works as well as theoretical training, and am accustomed to the control of men."

Unfortunately this applicant mentioned later that his age was 24, so he was promptly classed "with the goats."

Another application was one that was a model of all that an application should be; it tabulated in a clear and concise manner all the information that one desires on the front page, and on the following pages was a brief well-drawn-up letter stating the applicant's experience. The surprising thing was that another application drawn up in exactly the same manner came for the same job from a man in another part of the country; the data given were, of course, different, but the style and method of arrangement were identical. It left one wondering by how much the candidate's natural desire to present his qualifications in a favourable light had been improved on by a professional hand, and how big a pinch of salt was necessary before accepting the statements submitted.

Some candidates have all their testimonials printed, as well as tabulated statements of their training and experience; then the application takes the form of a covering letter drawing attention to the special points in their testimonials, &c., which have a direct bearing on the job advertised. This seems to be quite a good method, but some carry it to an extreme, and one comes across printed applications with blank spaces left for filling in the particulars suitable for the occasion, as—"Dear Sir,—Having noticed in this week's ———— that you are advertising for ————, I herewith make application for same." The impression which such an application leaves is that a number of these forms must be filled in and sent off each week to justify printing a form which ceases to be up to date within a few months.

The use of the firm's official paper and envelopes shows a lack of sense, for, naturally, the manager or chief to whom one applies will think that, if paper and envelopes are taken, other of the firm's property might be taken also if occasion offered, and the candidate is prejudiced in his eyes.

No one can lay down the law as to how an application should be drawn up. It must vary with individuals and circumstances, but perhaps these few lines may make intending applicants think a moment before writing, and so prevent them from making those blunders which are due principally to want of thought, but for which a heavy price in disappointment may have to be paid.

PROCEEDINGS OF INSTITUTIONS.

Starting and Speed Control of Induction Motors.

By F. C. Aldous.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, January 14th*, 1913.)

In the following paper two and three-phase motors only are considered, which may be taken as having the same characteristics for starting and speed control. Single-phase motors are started on light load, and, being only to a limited extent suitable for speed regulation, are not dealt with in this paper.

The type of motor which is most suitable for any particular service is determined by the conditions of the load, which may be classed as follows :—

1. Constant speed, where after being started the motor has to run at one speed only.

2. Variable speed, where the motor may operate at more than one speed.

For constant speed, many engineers are strongly prejudiced in favour of the slip-ring induction motor, as opposed to the squirrel-cage motor. The latter has many advantages not possessed by the slip-ring motor, and can be used in many cases where the slip-ring motor would be impossible.

It can be used in practically all cases where it normally runs at a constant speed, and up to a size such that the starting current shall not cause undue disturbance to the voltage of supply.

As a rough rule it may be said that when running off the mains of a supply company, the horse-power of a squirrel-cage motor which has to start on heavy load should not exceed 5 per cent. of the K.V.A. of the total minimum generating plant, or 10 per cent. if it starts on light load. On a large power system lower figures than the above would have to be taken. On a self-contained system, such as a group of collieries with their own generating plant, these figures may be easily doubled, since the permissible voltage drop will be greater. A mill which is group driven by squirrel-cage motors can be started up with the generator; power is supplied to the motors at a very low frequency, so that the starting conditions are very good and the whole mill is run up together. In a case like this the motors are provided with starters, so that if it is necessary to shut down a group it can be started again without shutting down the whole mill. The horse-power of any individual motor may in this case be as high as 20 per cent. of the K.V.A. of the turbo-generator.

For variable-speed work the slip-ring motor is generally preferred to the squirrel-cage motor, but where the motor operates at low speeds only for short periods, or where the use of slip-rings is objectionable, squirrel-cage motors may be used with advantage, especially in small sizes.

If good speed regulation is required at several speeds, as for machine-tool driving, or if full-load torque is required for long periods at reduced speeds, a multi-speed motor, which is generally of the squirrel-cage type, is preferable. For two-speed motors with a ratio of speeds 2 : 1 this can be done by using a winding which is connected for one number of poles for the low speed, and for half that number for the high speed. For other ratios, or for more than two speeds, it is necessary to use two windings, which might, for instance, be connected for 6, 8, 12, or 16 poles, giving a very useful range for variable-speed work. Where suitable speeds cannot be obtained by the use of multi-speed motors, this can often be done by means of "cascade" control, or the cascade motor of Mr. L. J. Hunt can be used.

If the torque required at low speeds is very much reduced, as in the case of fan-driving, a normal slip-ring motor with rheostatic control generally gives the best results. The input to the motor is reduced about in proportion to the square of the speed. The simplicity of the slip-ring motor with rheostatic control and its low first cost render it preferable to the different complicated systems which are now put forward, showing a high efficiency at all speeds.

Squirrel-cage motors of small size can be started by switching full voltage on to their terminals. In this case about six times full-load current is taken momentarily, which current is independent of the load to be started, though its effect on the supply voltage is, of course, more noticeable when starting a heavy load than when starting a light load. The torque developed may be about twice normal torque. Above a certain size, say, 5 to 10 H.P., the starting current is usually considered excessive, and an auto-starter or star-delta starter, or in the case of two-phase motors a series-parallel starter, is used.

If different voltages are thrown on to the terminals of a motor, the current varies directly as the voltage, whereas the torque varies as the square of the voltage; so that a motor which with full voltage on its terminals gives twice normal torque, and takes six times normal current, will, when 50 per cent. of full voltage is thrown on its terminals, give half normal torque and take three times normal current. If this is done by means of an auto-starter with a 2 : 1 ratio, then when the current in the motor is three times normal, the current in the line is 1½ times normal, since the K.V.A. on the primary and secondary of the auto-starter are equal. In the same way it is found that with a tapping giving 70 per cent. of full voltage, three times normal current is drawn from the line, and full-load starting torque is developed.

With the star-delta starter the motor is designed to run connected in delta. Leads are brought out from both ends of each phase, and by means of a double-throw switch the motor is started in star connection, and when up to speed is switched over to delta connection. By this means rather less than 60 per cent of full voltage is thrown on to each phase at starting, corresponding to an auto-starter with a 60 per cent. tapping. The series-parallel starter used with two-phase motors in which the windings are connected in series for starting, and in two parallel circuits for running, is seen in the same way to have the same effect as a 50 per cent. tapping. The total energy absorbed during starting is not reduced by using a reduced voltage at starting. When a squirrel-cage motor starts against a load consisting entirely of inertia, the total energy absorbed and the heating of the motor during starting are independent of the starting voltage. If the load consists partly of a friction load, the energy absorbed and the heating of the motor are reduced if the starting voltage be increased.

A high starting voltage is preferable where there is no objection to the consequently heavy starting current.

Sufficient starting torque can usually be obtained by taking a normal slip of 4 or 5 per cent., though on motors of large size this value of slip can generally be somewhat reduced. High-speed motors especially, for pump driving, requiring a comparatively

small starting torque, are generally designed with a normal slip of not more than 2½ to 3½ per cent., giving an increase of efficiency at normal load and a reduced starting torque.

When specially heavy starting torque is required, as for crane motors and motors for operating sluice valves or small compressors, squirrel-cage motors are built with rotors of much higher resistance, giving a slip of 8 to 10 per cent. at normal load. The rotors are specially built to withstand the heat developed in them without deterioration, and the motors are generally started by switching full voltage on to their terminals, or, in the case of crane motors, are controlled by varying the terminal voltage by means of an auto-transformer provided with different voltage tappings.

In fig. 1 are shown the speed-torque curve, A, and current-torque curve of a motor of 10-H.P., three-phase, 50-cycle, 400 volts, 950 R.P.M., having a normal current of 13·5 amperes per phase and a normal torque of 55·3 lb. at 1 ft. radius. This curve shows that the torque at starting is just twice normal, increasing to a maximum of 3·2 times normal at 670 R.P.M. and coming down to normal torque at 950 R.P.M. Curves B and C are drawn for motors having the same stator winding, and rotors of respectively two and three times the resistance of the first motor. The other curve shows the stator current, which is the same for the different motors at the same torque. Fig. 2 shows the rate at which the above motors speed up and the current curves during starting. Curves A and A_1, fig. 2, refer to the above motor A, fig. 1, when starting on full voltage against a friction torque equal to full-load torque, the load having a fly-wheel effect of 100 lb. at 1 ft. radius. Curves B, C, B_1 and C_1, fig. 2, give respectively the speed and current for motors B and C when started under the same conditions. Curves D and E refer to the first two motors A and B, still starting against the same load; but, in this case, the motor is started with an auto-starter giving 75 per cent. of full voltage on the motor.

It will be seen from these curves that a motor with a good overload capacity and with a normal slip of 5 per cent. will give a good starting torque without taking an excessive current. By carefully comparing these curves with those drawn for a rotor of high resistance, it is seen that with 10 per cent. normal slip a higher

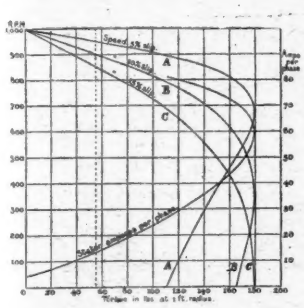


FIG. 1.—SPEED-TORQUE AND CURRENT-TORQUE CURVES.

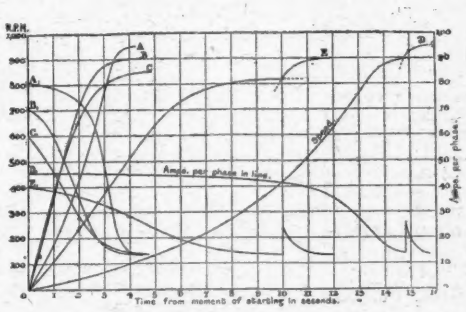


FIG. 2.—SPEED AND CURRENT CURVES DURING STARTING.

torque and a considerably lower current are obtained at starting, and of course a lower efficiency at normal load, but that there is not much advantage in increasing the slip above 10 per cent. In these curves the rotor resistance is assumed to be unaffected by temperature.

The heating of the motor is dependent upon the starting voltage. In order to give an idea of what this heating may amount to, an example is given of the starting of a squirrel-cage motor which drives by a belt a heavy mining fan. These fans, owing to their great inertia, are well known to impose very severe starting conditions upon squirrel-cage motors. The fan delivers 100,000 cb. ft. of air per minute against 4½ in. W.G. Its runner has a weight of 1 ton and a radius of gyration of 3 ft., and its speed is 415 R.P.M.

The motor is of 100 H.P., three-phase, 50-cycle, 500 volts, 720 R.P.M., and starts on a 70 per cent. voltage tapping. It has a starting torque with the rotor cold of 1·75 × normal with full voltage, and a normal slip of 4 per cent.

The rotor is heated up during starting far more than the stator. It cools off very rapidly, and after about 1 minute almost attains its normal temperature.

When the motor is first started, the rotor heats up so rapidly that though the current is diminishing the rate of heating increases, owing to the fact that the resistance of the rotor is increasing. After 30 seconds, when the motor is nearly up to speed, the rotor still has a temperature rise of 95° C., corresponding to an increase in slip of nearly 40 per cent. above its slip when cold. On switching over to full voltage the motor comes up to a speed of 712 R.P.M., and gradually creeps up to its normal speed of 720 R.P.M. as the rotor cools off.

The rotor has a maximum temperature rise of 126° C., meaning an actual temperature of perhaps 150° C. This is not excessive, since a rotor of good design and construction can stand temperatures far in excess of this without deterioration. When running at normal load the rotor has a temperature rise of less than 20° C., and the heating which occurs during starting is entirely local, since there is not sufficient time for heat to be transmitted to the stator.

Though the temperature of 150° C. is not sufficient to melt solder, it would certainly be undesirable to use solder on a rotor which operates under such severe conditions. Any screwed or riveted contacts would be liable to deteriorate under such conditions, even if the design and workmanship were very carefully carried out, and the only thoroughly satisfactory design is one in which all the contacts are brazed or welded.

DISCUSSION.

PROF. MILES WALKER said that with regard to variable-speed control, he was partial to the use of auxiliary machines generating a back E.M.F. Of course large machines were referred to, and in all probability the use of a booster in the rotor circuit would be extensively employed in the future. The booster arrangement was very simple, the rotor of the induction motor being connected in series with the armature windings of a small D.C. generator excited from a special small exciter. The whole arrangement could easily be controlled by automatic switchgear, and one of the simplest methods of varying the speed was to rock the brushes on the D.C. generator. This arrangement seemed to have a wide future for rolling mills.

MR. FAYE-HANSEN said that with slip-ring motors of modern design, especially for low periodicity, the rush of current if switched on to the full voltage might be as large as, or larger than, the current taken by the squirrel-cage motor starting from an auto-transformer. This kick, however, only lasted for a very small part of a second, and if required could be greatly reduced by using a switch having an auxiliary contact which at the first step put a resistance in series with the motor. The speed control of squirrel-cage motors had the disadvantage that the maximum torque was reduced as the square of the voltage applied, so that if a large torque was required at low speeds, the motor might get unstable. It shared also with the slip-ring motor the disadvantage that if run at low speeds, the speed changed very much with an alteration in load. This and the low efficiency of these motors at low speeds justified in many cases the use of pole-changing motors or cascade control of some kind, notwithstanding the increased cost and complication. Regarding the control of pole-changing squirrel-cage motors, it must be remembered that as a rule it would not be allowable to switch the motor directly over from one speed to the other, as the rush of current might then be nearly as great as if the motor were started from rest at full voltage. In going over from one speed to another, therefore, the tappings on the auto starter would, as a rule, have to be used. In some cases multiple-point starters were called for, but this was very seldom justified, as nearly always the rush of current to start up the motor was very much greater than the rush of current in switching over from the starting tap to full voltage. An important drawback to the use of multiple-point starters was that fairly heavy currents would have to be broken, while in a two-point starter, as a rule, only comparatively small currents were switched out. The current density in the motor at the moment of switching in was, approximately, 26,000 amperes per sq. in. The author was rather too severe in condemning riveted, screwed and soldered joints in all squirrel-cage motors, though he was justified in doing so in all cases where such heavy starting conditions occurred. There had also been made some short-circuited rotors without any joints at all, the winding being punched out of sheets, pulled into shape, and then placed in the slots. A winding having independent short-circuited turns had the advantage that the tendency to creeping speeds due to higher harmonics in the field form was reduced.

MR. W. CRAMP said the example of constant-speed drive in a mill, as quoted by the author, might be applied with advantage to many cases where a large number of line shafts or machines had to be started together, but he thought it much better to excite the alternator separately at starting. The statement that the rotor of a squirrel-cage induction motor would run synchronously with the magnetic field of the motor at no load was quite erroneous. Whilst discussing the question of speed variation the speaker referred to a type of squirrel-age rotor having two windings, one at the surface of the rotor as usual, and the other embedded in the rotor close to the shaft. The effect of this arrangement was that when starting, the frequency being high, only the outer winding would be affected, but as the frequency diminished the inner winding would come into play, thereby reducing the rotor resistance. Some years ago, a repulsion-induction motor had been built by him along these lines with very satisfactory results. In this case, the repulsion motor winding was in slots around the rotor periphery, and this winding carried most of the current at starting. Below this winding was a squirrel-cage rotor winding, which, as the motor approached synchronism, carried more and more current. The result was a machine having an excellent starting torque, a small commutator with short-circuited brushes, excellent commutation and a general characteristic load-speed curve like a compound-wound direct-current motor. It was made originally for single-phase circuits and for fan driving. It could be thrown straight on to the line without a starter, as all necessary regulation could be obtained by rocking the brushes.

MR. B. THOMAS said the examples of constant-speed driving and method of starting up were very interesting, but it was doubtful whether the system could be adopted in cases of friction load. Some friction loads were very great, a case in point being that of a motor-driven air-compressor. When single-cylinder machines had

to be dealt with, a starting device operated in conjunction with the compressor valves had been found necessary.

Mr. J. Frith said that partial insulation of the rotor winding on squirrel-cage machines was no good at all. The windings should either be thoroughly well insulated or connected to the core at every point. Rotors of solid cast-steel had been used with great success in crane work. They started well, and owing to their high power factor, the current was comparatively small.

Prof. Marchant said that, in the case of one motor in his laboratory, there was quite a strong seventh harmonic in the flux wave, which caused the motor to run fairly steadily under certain conditions at one-seventh synchronous speed. It was sometimes quite difficult to get it to run through this speed when starting. This phenomenon was found mostly in motors with a small number of slots per pole per phase, and seemed to be particularly marked in motors which were fitted with pole-changing devices. From this point of view, the wound rotor had an advantage over the squirrel-cage rotor.

The Author, in reply, said that six times normal was the usual figure for the starting current of squirrel-cage motors. Some motors, particularly high-speed machines, took more than this, but if the starting current was reduced much below the figure quoted, trouble would probably arise. He wished to emphasise the desirability of aiming at a good starting torque. The scheme explained by Prof. Walker was particularly interesting, as some system of that kind was essential for variable speed control. It was a difficult matter to decide what system to install in rolling mills, as variable speed control was essential in addition to a heavy torque. Regarding Mr. Faye-Hansen's remarks, what he (the author) referred to expressly was the current which flowed for a second or so after switching. The determination of the short-circuit current was far more difficult than that of the no-load current. In the case of the short-circuit current, it was necessary to determine the size, number and shape of slots together with details of the end connections, and altogether it was a complicated business, and if there was any doubt about calculating the value, a good margin should be allowed. Concerning the heating of the rotor winding, he maintained that in certain types of windings there was no time for the heat to be transferred to the core. In many cases it had been found that the heating of the part of the winding inside the core was greater than that at the ends of the core. The figures given in the paper formed a rough idea of what to expect, and it was necessary to calculate the heating of the windings as independent of the core. Experience had shown that it was best to eliminate joints where possible, especially in small machines. The rotor of a squirrel-cage motor did not exactly run synchronously with the magnetic field, but the difference was so small as to be immeasurable. The energy absorbed by a squirrel-cage motor exceeded that absorbed by a slip-ring motor at starting. Regarding the question of saturation, all calculations had been made assuming the current proportional to the voltage, and this seemed a very true estimate. Squirrel-cage motors were admirably suited to operating small air-compressors.

Some Methods of Magnifying Feeble Signalling Currents.

By S. G. Brown.

(Abstract of discourse delivered at the Eighth Annual Exhibition of Apparatus, held by the Physical Society, *on December 17th,* 1912.)

Telegraphy over long submarine cables is continually on the increase, and it is a fairly accurate statement that the number of messages sent doubles itself every 10 years. It is therefore important that, besides the increase in the number of the cables laid down each year, means should be devised to increase the carrying power.

The instruments which I have invented and am about to describe were designed primarily for cable work, but they are easily applicable to recording many other kinds of signalling impulses.

Lord Kelvin invented the siphon recorder about 45 years ago; he designed it so carefully that no improvement in its sensitiveness has been brought about until now.

The ordinary siphon tube is about 2½ in. long and from 8 to 12 mils in diameter. The moving coil consists of 500 turns of 2-mil wire at a mean radius of ⅜ in. The coil and siphon are mounted on separate axes and are connected by silk fibres so that the angular movement of the siphon is about two to three times that of the coil. By reducing the length of the siphon to ½ in. and substituting a narrower coil it is possible greatly to increase the sensitiveness of the recorder.

In order to make the inertia effects of the moving system a minimum, it is advisable to make them equal for the coil and the siphon. Even a narrow coil of 300 turns has about 100 times more inertia than the siphon, so that it is necessary to move the siphon through $\sqrt{100}$ times the angle moved by the coil. By reducing the number of turns on the coil and increasing the field it is possible to reduce the natural period for a given sensitiveness and back E.M.F., but in practice it is inadvisable to reduce the turns on the coil below 50 or 100. Means of magnifying the motion of the coil and transmitting it to the siphon have to be used. In this instrument (fig. 1) it is accomplished by means of a fine fibre, E, which is kept in tension by flat springs at each end. The fibre is attached to an arm carried by the moving coil A, and to a vertical fibre, F, on the siphon suspension.

The siphon is carried on an aluminium carrier to which a single central fibre is attached at the top and two parallel fibres, F, 0·2 in. apart below. One leg of the siphon lies on the axis of the suspension and dips into a small opening in a pipe extending from the ink-pot.

In order to produce an ink line on the paper without introducing friction, the siphon must not touch the paper even momentarily, and arrangements have been made to jerk the ink in fine drops on to the paper. To accomplish this the whole of the siphon suspension is vibrated rapidly up and down between the springs V and K

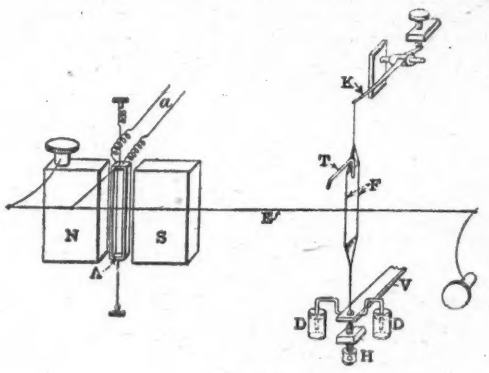


Fig. 1.

by means of the spring V, which is attached to a vibrator. To impart a jerk to the siphon, a stop, H, is fixed directly under the axis of suspension, and two little dash-pots, D D, on either side prevent the spring bouncing on the stop.

When the instrument is adjusted to have a natural frequency of 10·5 per second, with a 300-ohm 300-turn coil, a current of 50 micro-amperes gives a full-sized signal corresponding to a deflection of

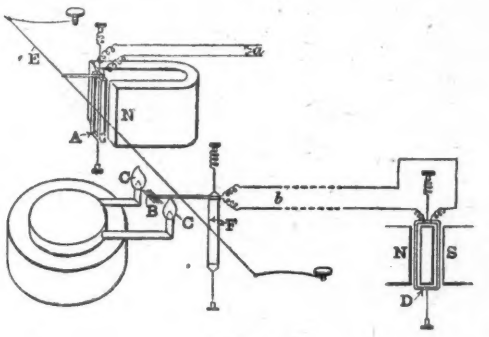


Fig. 2.

0·1 in. on the paper. Under these conditions the back E.M.F. of the coil is only about one-quarter to one-fifth of that of the ordinary recorder coil.

Trials with this instrument have shown an increase of speed of 30 per cent. on the longest Atlantic cables.

In the thermo-electric magnifying relay, fig. 2, the power in the relay circuit is generated by means of five thermo junctions at different temperatures. The heat is supplied by two little flames, C C, and a

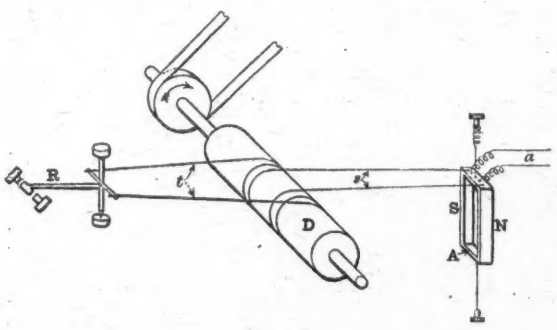


Fig. 3.

very light thermopile, B, is suspended so as to swing in and out of the flames, and is coupled to a moving coil through which the received currents pass. The thermopiles consist of alternate junctions of platinum and platinum + 20 per cent. iridium, wires being used of 1 mil. diameter. The wires are melted on to a fine glass tube about 10 mils diameter. For moving the thermopile in the flames similar arrangements to those just described for the siphon recorder are employed.

An alternative arrangement which gives greater sensitiveness and enables heavier thermopiles to be used is to fix the thermopiles

and vary the flames by means of a valve or shutter actuated by the coil movements.

As the thermopile current depends on the difference of temperature between the junctions, a certain time is required to heat the wires. It is found that for cable work, where the frequency seldom exceeds 10 per second, the lag is inappreciable, but for considerably faster movements it becomes important. In duplex working, when the sending current has to be balanced so as not to affect the receiver, quick "jarry" movements are very difficult to eliminate, but the lag in the thermo instrument reduces these movements very considerably and is a valuable property.

When a thermopile with seven junctions on each side was deflected 0·075" the current sent through a resistance of 42 ohms (equal to its own resistance) was 0·81 milliampere. With the natural period of the coil equal to 8·7 per second and a 480-ohm 480-turn coil, a current of 0·03 milliampere through the coil gave a current of 0·81 milliampere from the pile through an external resistance of 42 ohms. For slowly changing currents this corresponds to a magnification of power of about 27 times, and, of course, this can be greatly increased by reducing the period of the coil. For quickly changing movements the power magnification is not so great, owing to the back E.M.F. of the coil. Trials of this instrument on an Atlantic cable have shown an increase in speed of about 40 per cent.

The instrument just described is a magnifying relay—that is to say, it multiples the impulses received in exact proportion to their strength. This form of relay is quite distinct from an ordinary make-and-break relay, which delivers a constant current for any impulse over a certain strength. For very many purposes it is essential that received impulses should be magnified without altering their shape, and this can only be done by an instrument with a constant magnifying power.

This property I will now illustrate in an entirely mechanical relay in which movements operated by very small forces are largely increased in strength without affecting their motion. The relay consists in principle of a rotating spindle around which are wound one or more turns of a flexible cord. The spindle is revolved in such a direction as to pull away from the magnified forces and towards the small forces that control the movement. Suppose a heavy weight has to be raised by a force of one-tenth of the amount, it will obviously be necessary to supply 90 per cent. additional energy, and this is supplied by the motor driving the spindle. The magnification of force and energy depends on the number of turns which the cord makes round the spindle and follows a compound interest law.

Fig. 3 shows an application of the principle to cable work, in which the small forces operating the coil A are intensified sufficiently to work the coarse relay arm R. The spindle rotates away from the relay arm R and towards the coil, and produces a much greater tension in the fibres t than in s. When the coil swings on its axis the tension is increased in one of the fibres and diminished in the other and a similar change in a magnified degree takes place in the fibres t.

By using means of this sort it is possible to work an ordinary siphon direct writer (which normally requires some3 milliamperes) by a current of 10 microamperes.

American Electrical Installations.

AT a meeting of the YORKSHIRE SECTION of the INSTITUTION OF ELECTRICAL ENGINEERS on Wednesday, the 12th inst., Mr. T. Harding Churton delivered a lecture on "Some American Electric Plants."

MR. CHURTON dealt first with the generating stations deriving their water power from Niagara. Tracing the history of the Niagara Falls Power Co., he stated that the three present stations of the company had a total capacity of 160,000 H.P. The two stations on the American side had in operation 21 generators, each capable of delivering continuously 5,000 E.H.P., whilst the station on the Canadian side had five generators of 10,000 E H.P. The three stations were interconnected so that either power house could act as a reserve for the other two. The turbines in the American power house No. 1 were Fourneyron inverted twin turbines designed by Faesch & Piccard, of Geneva, those in power house No. 2 were Francis single turbines, equipped with draught tubes, and designed by Escher, Wyss & Co., of Zurich; and the turbines in the Canadian plant were Francis double inward discharge turbines, with draught tubes, designed by the same firm. All the generators ran at a speed of 250 R.P.M. Speaking of the Electrical Development Co., of Ontario, and the Ontario Power Co., he described their machinery in detail, and mentioned that from the transformers at one of the sub-stations of the latter company, the voltage was stepped up to 60,000 volts, at which voltage energy was transmitted as far as Syracuse, New York State, 160 miles away. The line consisted of aluminium conductors 1/4 in. in diameter, carried on steel towers, 55 ft. high to the top wire, with an average span of 500 ft., the insulators being of porcelain and weighing 35 lb. each. In the immediate vicinity of the station the current was sent out untransformed at 12,000 volts, and delivered to the transformer station of the Hydro-Electric Power Commission of the Province of Ontario for transmission and distribution at 110,000 volts. The system of transmission lines of this Commission was 300 miles in length, and included municipalities within a distance of about 150 miles from Niagara, embracing the City of Toronto. The current was at 25 cycles, and he noticed that in large rooms where there were many lamps the flicker due to the low frequency was quite perceptible, particularly from lamps not directly in the line of vision. Mr. Churton went on to describe two hydro-electric plants in British Columbia—one, that of the British Columbia Electric Railway Co., Ltd., and the other, that of the Western Canada Power Co.—the water for which was derived from Lake Buntzen and Lake Stave respectively. In the case of the British Columbia Electric Railway Co, he said that the company also supplied light and power, and a notable increase in the consumption at private residences had been observed, which was due to the adoption of electrical cooking and heating appliances. Here, also, the use of electricity for illuminated signs for advertising purposes had been developed to a most wonderful extent. Among the special features at the Vancouver sub-station of this company might be mentioned the installation of three six-phase 60-cycle rotary converters, which were among the largest of their kind in the world. Speaking in regard to two steam-driven plants which he had visited—the Delray plant of the Detroit Edison Co. and the Fisk Street plant of the Commonwealth Edison Co., Chicago—he said the features that struck him particularly were the large size of generating units adopted, the compactness of the plants, the great extent of the labour saving devices and the excellent organisation and appointments everywhere observed. At the Delray station the coal consumption was equal to about 2 23 lb. per KW.-hour delivered, the thermal value of the coal being 14,000 units, and the cost delivered about 10s. a ton. The Fisk Street station plant already contained 10 14,000-KW. sets, but the demand was so great that an extension was now in progress which, when completed, would embrace four additional sets of 25,000 KW. each; the first of these sets was being built at Messrs. C. A. Parsons's works at Heaton-on-Tyne. This generator would be capable of giving continuously 25,000 KW., but its most economical load would be 20,000 KW.; it would generate three-phase current at 25 cycles, 4,500 volts, at a speed of 750 R.P.M. The lecture was very fully illustrated by means of lantern slides.

In the course of a discussion which followed, many questions were asked, and MR. CHURTON, in reply, said he thought the reason for using 25 cycles was that it afforded greater facilities for long-distance transmission than higher-frequency current did. As to charges for power, the price in Toronto was 2½d. per unit for the first 50 units used in a month, ½d. for the second 50 units, and ¼d. for the third 50 units. At Vancouver for power there was a charge of 4s. per H.P. on the rated load per month, plus ½d. per unit used, up to 100 H.P., over that ¼d. per unit up to 200 H.P., and over 200 H.P. ¼d. per unit. At Toronto, for lighting the charge was 4d. per unit for the first 25 units, and a reduction of 1½d. per unit for all over that. At Vancouver the charge for lighting was 5d. for the first 50 units and a sliding scale down to 1½d. per unit for all over 1,500 units per month. In regard to a question as to liability to accidents, he thought that the construction was so very strong that the liability there was rather less than it was here, and, of course, the high voltage made no practical difference to the risk of shock. In regard to generating costs, he took it that the prices at which the energy was sold were a fair indication, but it should be remembered that the generating costs of water-power plants were made up in a totally different way from those of steam plants. The cost of running a water-plant station must be fabulously less, because the labour bill was next to nothing. In a power house with 50,000 or 60,000 H.P. there would be one man walking about the place with practically nothing to do. In regard to wayleaves, the lines that went from Niagara to Toronto were over private ground all the way, and to a large extent that would apply to the others; where public roads were crossed there were additional protections and safeguards.

CONTROL OF METERS AND LAMPS FROM THE CENTRAL STATION.

ON Friday last we took part, on the invitation of Messrs. Handcock and Dykes, in a visit to Staines to witness a demonstration of a new system of controlling apparatus connected with a network of distributing mains, without the use of pilot wires and without affecting any other consuming apparatus on the mains in any way. The new system is the joint invention of Mr. W. Duddell, President I.E.E., and Messrs. Handcock & Dykes, and was described in a recent communication to the *Journal* of the Institution of Electrical Engineers, from which we abstract the following particulars:—

The underlying principle is to control relays, which may be inserted anywhere on the general system of mains, by means of a superposed current impressed on the main current flowing in the system. If the main current be continuous, then the control current may be alternating, of any desired frequency. If the main current be alternating, then the impressed current must be of a different frequency, the relay in either case being so designed that, while it instantly responds to the impressed current, it is unaffected by any alteration of the main current or pressure.

As long as the feeder bus-bar voltage is kept constant the amount of power supplied to consumers is practically unaffected by the ripple. The output of the main generators is simply reduced by an amount equivalent to the power produced by the "ripple generator."

In direct-current systems the solution is simple. The relay is connected as a shunt across the mains and in parallel with the lamps and with the meter to be controlled. If a condenser be placed in series with the relay, it is obvious that as long as there is only a continuous voltage on the mains, no current passes through

the relay. As soon, however, as an alternating voltage is impressed on the mains a current passes through the relay and causes it to actuate the particular mechanism required.

When the main supply is alternating the problem is not so simple, inasmuch as the condenser will allow a current to pass through the relay from the main 200-volt 50-cycle supply as well as from the small superposed ripple. The relay must in this case be made "selective," so that it will operate only when a current of the selected frequency is impressed on the line. Such a selective relay is also to be preferred for a direct-current supply as it enables several relays adjusted for different frequencies to be employed, any one of which can be brought into action as required.

In order to achieve this result, the inventors take advantage of the principle of resonance, and so choose the self-induction of the relay L, and the capacity of the condenser K, that at the frequency F, at which the relay is intended to operate, they are in resonance, whilst at the normal frequency they are not. That is to say, neglecting resistance, the following relation is established:—

$$L \times K \times (2 \pi F)^2 = 1.$$

When this relation holds, the potential differences between the terminals of the relay and of the condenser are much greater than the applied potential difference, and, consequently, the current passing through both the relay and the condenser is much greater

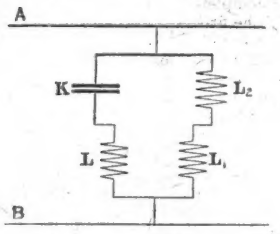


FIG. 1.

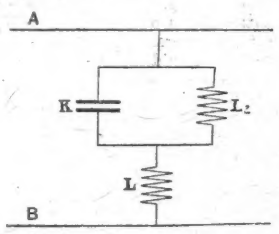


FIG. 2.

than that due to the applied voltage. The two potential differences are out of phase with each other, and their vector sum is equal to the applied voltage. In practice they find the potential difference between the terminals of the relay coil at the resonance frequency to be some 10 times the applied potential difference.

It is found best to adopt, on alternating circuits, frequencies comprised between the third and fifth harmonics of the supply.

A satisfactory value for the R.M.S. value of the superposed voltage is 5 per cent. of the supply voltage, whether direct or alternating. That is to say, on a 100-volt circuit, direct or alternating, the R.M.S. voltage of the ripple is to be 5. The simple resonance circuit described above works perfectly in the case of a D.C. supply, and has many advantages over the non-resonant relay; but in the case of an A.C. supply, unless the resonance be made unduly sharp, or there be a large difference between the frequencies, the condenser K and relay L will let through sufficient current at the supply frequency to attract the armature of the relay.

To get over this difficulty the inventors add a compensating circuit to the relay, as illustrated in fig. 1, where L is the relay coil, the armature and core being omitted for the sake of clearness. On top of this coil is wound a second coil, L_1, which may have, roughly, the same number of turns, and this coil is connected in series with a choking coil, L_2, having a high self-induction. The current through the condenser K and relay coil due to the supply frequency, say 50, leads almost 90° on the applied potential difference. The current through the choking coil L_2 and compensating windings L_1 is made to lag about 90°. If these two currents be adjusted to approximate equality, their action on the core of the relay can be made very small. A compensated resonance relay of this sort will work with certainty at 5 volts at 200 frequency and will take no notice of 100 volts at 50 frequency. This relay would only operate when it should not if the voltage of supply were allowed to rise from 100 to somewhat over 200 volts, so there is no fear of failure from this cause.

Failure takes place when the superposed voltage is reduced to about 3·5 volts. If the superposed voltage be maintained at its normal value of 5 volts a variation of some 5 per cent. can be made either way in the frequency before the relay fails to act.

The relays are adjusted for use on a 100-volt 50-frequency supply. The capacity of the condenser K is 2 mfd., and the self-induction of the relay winding L, 0·3 henry. The compensating winding L_1 is wound closely on top of L, and has approximately the same number of turns. The choke coil L_2 is adjusted until the force acting on the armature produced by the 50-frequency current is a minimum. Under these conditions there flow through K and L, and also through L_2 and L_1, two currents, each approximately 0·06 ampere, and having a phase difference of somewhat less than 180°. The current taken from the mains is the vector sum of these two currents and only amounts to 0·02 ampere. The true power taken at 50 frequency and 100 volts is 0·7 watt. At 200 frequency and 5 volts, the currents through the two circuits are no longer equal, that through K and L being 0·15 ampere and that through L_2 and L_1 0·01 ampere. The current through the relay winding is nearly in phase with the applied potential difference between the mains, whilst the current through the compensating winding L_1 lags about 90°. Hence, the ampere-turns on the two windings of the relay are nowhere nearly equal, and consequently there is a force acting on the armature. The actual power taken at 200 frequency and 5 volts is about 0·7 watt.

These figures are given as an example. It is of course quite easy to modify them by slight alterations in the windings of the coil. The windings on the relay coil are arranged so that the current would flow round the core in the same direction if a continuous current could be passed through the two circuits as connected up, that is to say, if the condenser were short-circuited. This means that the two windings can be converted into one, and the arrangement illustrated in fig. 2 can be used, which is electrically identical with that in fig. 1.

In order to superpose the ripple on the supply, whether D.C. or A.C., the simplest way is to put a small high-frequency alternator in series with the main generators. Where high voltages are employed, and also in the case of direct-current supply, the secondary of a transformer can be placed in series with the main generators and the primary be connected to the high-frequency alternator. Several relays adjusted for different frequencies can be connected to the same supply and be brought into action by varying the speed of the high-frequency alternator.

By inserting relays in the bases of the lamp-posts, street lighting can be switched on or off from the station, either as a whole or in sections as may be desired. Arc lamps or high-power lamps can be switched off at any desired time and smaller lamps substituted for them. Transformers in sub-stations can be cut in and out exactly as required. Effective control can be maintained over the main switch on the premises of consumers who are taking current at special rates during restricted hours. In return for a small payment shopkeepers can have lights burning for window display or for advertising purposes till any agreed hour, when they can be switched off from the station by means of a relay fixed on the premises. In many residential districts public clocks are either absent or so unreliable that a ready means of setting the domestic clocks would be very desirable, and there are a number of people who would be very willing to pay a small sum per annum to have installed on their premises a relay which would be actuated from the station, and would give an audible signal daily at, say, 8 a.m. Greenwich mean time.

The compensated resonance relay should be of considerable assistance in electric track signalling on railways.

The increasing use of electricity for various domestic purposes other than lighting has increased the need for some simple system of charging. Every one can understand selling current at one price when the station is busy, *i.e.*, at peak load, and at a much lower price at slack times, when otherwise some of the plant would be more or less idle. It does not matter in the least to the station for what purpose the current is used. In some A.C. stations in residential districts the two-rate system has been introduced as an alternative to a flat rate, and by far the greater number of consumers have elected to take the two-rate system despite the increased meter rental entailed by the necessity of having two separate meters and a clock switch. In such districts where the plant is always running, one can obviously afford to sell current at a low rate off the hours of peak load.

It will be seen that the "two-rate system" presents many advantages, but the necessity for constantly altering the setting of the clocks and winding and keeping them in order is a serious drawback. Where two-rate meters are already installed, a simple relay, as described above (to which the name of "Handyell" has been given, pronounced "handle"), can take the place of the clock switch, thus effecting a considerable saving in first cost and in cost of upkeep. It has, moreover, the advantage that the time of operation can, if desired, be adjusted each day to suit the variation in the time of peak load.

This dispenses with the clock, but the inventors propose to go further and make the ordinary meter serve the purpose of a two-rate meter. At Staines, on the system of the Egham and Staines Electricity Co., Ltd., to which Messrs. Handcock & Dykes are the consulting engineers, electrical energy is sold at 7d. per unit; it was found that there was a lively demand for a supply off the peak at 2d. per unit, with two-rate meters, and the engineers, observing that if a consumer's meter were stopped for five minutes and allowed to run for two minutes, the result would be the same as that given by a two-rate meter, decided to adopt this method of charging. A small alternator is installed at the generating station, with a synchronous motor to drive it, and an automatic arrangement of cams and switches is used to break the field circuit of the alternator for two minutes out of every seven. During the other five minutes the alternator, which has a frequency of 200 cycles and voltage of 140 volts, and is connected in series with the 2,000-volt mains, supplies the "ripple" superposed upon the 50-cycle supply; each meter to be controlled is provided with a resonance relay, which breaks the shunt of the meter while the ripple is flowing, with the aid of a small mercury switch of the type widely used in sign flashers, and therefore of proved reliability. It should be mentioned that the supply is given through house transformers at 100 volts, so that the actual voltage of the ripple on the secondary circuit is about 5 volts, allowing 2 volts for drop in the mains.

During the peak, the high-frequency alternator is shut down and short-circuited, so that the meters work full time. The system has been in successful operation for some months, and no difficulty has been met with in explaining it to consumers.

The continuous consumption of power is 0·7 watt per relay at 50 cycles: when the ripple is in operation, a further 0·7 watt is consumed, at 200 cycles, making 1·4 watts per meter, but during this period (5 out of 7 min.) the shunt loss of the meter, say, 1·5 watts, is cut off. During the remaining two minutes, the shunt loss and the relay loss are added, so that, on the whole, there is a slight net loss due to the use of the relays.

In such a case as the above, the high-frequency alternator must

be capable of carrying the whole of the supply current continuously, and of generating the pressure necessary for the ripple, but the power required to drive it is only a fraction of its KV.A. rating thus derived. At Staines, the mains are single-phase concentric with the outer earthed, and the high-frequency generator is connected in series with the earthed conductor; but it is important to observe that the "Handyell" system is entirely independent of "earth," and is, obviously, equally applicable to a wholly insulated system. It will undoubtedly prove a valuable aid to the central-station engineer.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Pattern "Stannos" House Zed-Fuse Box.

MESSRS. SIEMENS BROS. & CO., LTD., are placing a new house fuse box on the market which is exceptionally compact, neat in appearance, and, we understand, low in price. Fig. 1 shows an open fuse box (half size) wired with "Stannos" wire on the concentric system. The continuity of the "Stannos" sheathing is

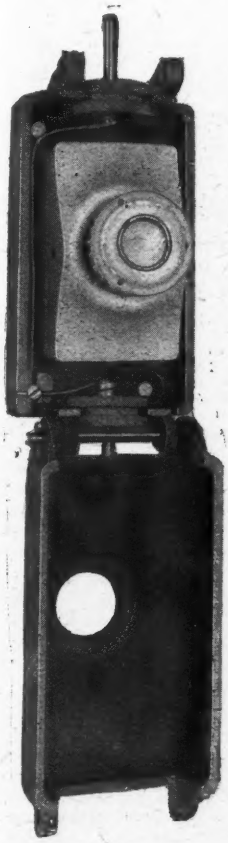


FIG. 1.—STANNOS HOUSE ZED-FUSE BOX.

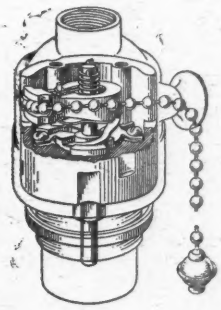


FIG. 2.—B.T.H. PULL-CHAIN SWITCH HOLDER.

maintained by means of "Twiston" connectors terminating at the left-hand corner, efficient contact being ensured by means of the screw, as shown. The box is also eminently suitable for use with ordinary braided wires. It has a capacity up to 15 amperes. Further particulars can be obtained from the makers.

B.T.H. Pull-Chain Switch Holder.

WE referred briefly in our last issue to the ingenious pull-chain switch holder recently placed on the market by the BRITISH THOMSON-HOUSTON CO., LTD. We are now enabled to give a more detailed description, with illustrations (fig. 2). The stiff, jerky action of the ordinary key-switch holder has always been recognised as a serious demerit, because of the risk of lamp breakage. The new B.T.H. Pull-chain Switch-Holder has a horizontal rotary action, controlled by a beaded chain hanging from the top of the holder. This action is so "sweet" and easy that the lamp can be switched on and off without the slightest vibration. Twelve inches of chain are supplied with each holder, so that if it is attached to ceiling fittings, the switching can easily be done from the ground. The contractor who fits a B.T.H. Pull-chain Holder to a table standard, and keeps it standing on his counter, is sure to make sales to many people who pull the chain out of curiosity, and then want to buy the whole equipment.

The "Fors" Car Lighting Dynamo.

The latest dynamo designed for electric lighting purposes on motor-cars, is that which has just been put on the market by MESSRS. RICHARD PAPE, LTD., Belvedere Works, Belvedere, Kent. The machine, which is electrically self-governing, is designed for use with the well-known "Fors" 12-volt storage battery. The dynamo, inclusive of the auto-switch, measures less than 10 in. long × 8 in. wide and 6½ in. high, and weighs 20 lb. complete as illustrated (fig. 3). The normal speed is 2,000 R.P.M. and the maximum output is 150 watts. The makers claim the following, among other advantages, for it:—Accessibility of the brushes and commutator, dust-proof joints, absolutely constant voltage by a special design of field magnets, and absence of mechanical complexity.

The brush casing can be readily detached by removing a locking

FIG. 3.—"FORS" CAR LIGHTING DYNAMO.

stud, and the position of the brushes may be varied to obtain the best result. The magnetic switch is bracketed to the carcass so that the whole is self-contained. The voltage regulation is effected by means of supplementary pole shoes, in conjunction with the field magnet, their purpose being to divert part of the flux of the main magnets. When the voltage of the dynamo is sufficient, the automatic switch closes the circuit between the dynamo and the battery, and when the speed is too low it disconnects the battery from the dynamo. A 12-volt battery of 40 amp.-hours capacity is intended to be used with this installation, but preferably a 75 amp.-hour battery is employed when the vehicle is required for constant use at night with fairly long periods of intermittent use of the engine. A neat switchboard forms part of the installation.

New Westinghouse Oil-Break Switch.

THE BRITISH WESTINGHOUSE CO. has recently brought out a small oil-break switch suitable for switchboard mounting on A.C. three-phase, 50-period circuits up to 125 amperes and 650 volts. It is constructed on the well-known metal and mica principle and has one or two unique features. The switch is simple in design and sound in construction, as will be recognised from fig. 4, which shows the switch with tank removed. It will be seen that the

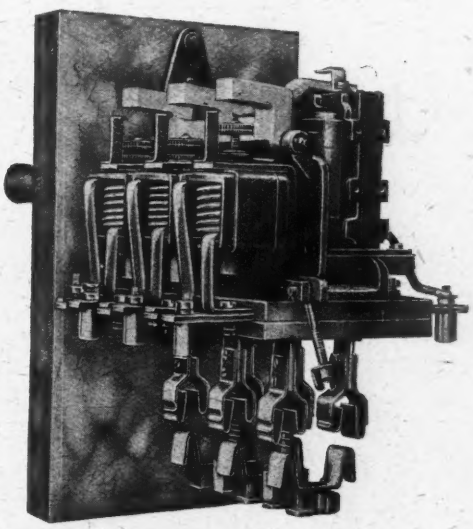


FIG. 4.—SMALL WESTINGHOUSE OIL SWITCH.

connections to the stationary contacts pass out through the side of the slate or other insulating material, this arrangement making it most convenient for connecting up.

Above the slate slab, on the left-hand side, the overload coils are shown, and these operate the tripping bar in the ordinary way. On the right-hand side of the switch, the no-volt release coil is fitted.

The switch is fitted with a loose handle arrangement, and it is impossible to close it when there is no voltage on the circuit.

The three moving contacts are mounted on a steel bar, insulated with moulded mica. The rods which connect this bar to the operating mechanism are of steel, and pass through guides secured to the base of the switch, thereby ensuring that the moving contacts have a parallel motion. It will be noticed that spiral springs are fitted, thus giving a quick break action to the switch.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,718. "Electric furnaces." F. C. Wardall and J. Marchant. February 3rd.

2,732. "Electrical switchgear." A. L. Tackley and Chloride Electrical Storage Co., Ltd. February 3rd.

2,740. "Electric heating devices." P. Good. February 3rd.

2,749. "Telephone transmission circuit." H. C. Egerton. (Convention date, July 18th, 1912, United States.) February 3rd. (Complete.)

2,752. "Electromagnetic service meter for telephone exchanges, and for other purposes." Siemens Bros. & Co., Ltd., and E. A. Petithory. February 3rd. (Complete.)

2,757. "Electrical switches." W. McGeoch & Co., Ltd., and W. T. Reynolds. February 3rd.

2,758. "Electrical switches." W. McGeoch & Co., Ltd., and W. McGeoch, jun. February 3rd.

2,764. "Lampholder used for imitation candles and other electric light purposes." E. Phillips. February 3rd.

2,772. "Cut-out for motor and other electric circuits." A. E. Culley. February 3rd.

2,778. "Electromagnetic switching mechanism for heavy current switches with automatic release." Bergmann Elektricitats Werke Akt.-Ges. (Convention date, February 1st, 1912, Germany.) February 3rd.

2,781. "Electric circuit closing bolts or latches for doors." P. R. J. Willis. (G. A. Spring, United States.) February 3rd.

2,803. "Ignition devices for internal-combustion engines." B. Hopps. February 3rd.

2,830. "Electric footwarmer to be used in connection with an electric battery or dynamo fitted to a motor-car." T. W. Joyce and E. G. Halfpenny. February 4th.

2,831. "Electric sparking plug, suitable for internal-combustion engines, the said plug having an attachment to indicate any form of misfiring, and also detachable firing points at extreme base." T. W. Joyce, H. E. Hibbs and E. G. Halfpenny. February 4th.

2,836. "Enclosures for arc lamps." H. Ayrton. February 4th.

2,868. "Electric heating and cooking apparatus." F. A. Wilkinson. February 4th.

2,898. "Electric storage batteries." G. O. Davies. February 4th.

2,901. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 4th.

2,908. "Construction of portable secondary batteries." E. J. Clark and Hart Accumulator Co. February 4th. (Complete.)

2,917. "Transmitting apparatus for use in wireless telegraphy and telephony." G. Marconi. February 4th.

2,918. "Transmitting apparatus for use in wireless telegraphy and telephony." G. Marconi. February 4th.

2,919. "Transmitting apparatus for use with wireless telegraphy and telephony." G. Marconi. February 4th.

2,928. "Telephone transmitters." E. Grissinger. (Divided application on 7,482/1912, March 27th.) February 4th. (Complete.)

2,929. "Telephone repeater circuits." E. Grissenger. (Divided application on 7,482/1912, March 27th.) February 4th. (Complete.)

2,930. "Telephone repeater systems." E. Grissinger. (Divided application on 7,482, 1912, March 27th.) February 4th. (Complete.)

2,931. "Telephone lines." E. Grissinger. (Divided application, No. 7,482, 1912, March 27th.) February 4th. (Complete.)

2,946. "Fittings designed for employing direct and indirect lighting in combination." M. P. Maclaren. February 5th.

2,951. "Electric imitation candle." R. Groves. February 5th.

2,958. "Replaceable electric fuses." A. Williams. February 5th.

2,971. "Dynamo-electric machinery, particularly that used for starting internal combustion engines (more especially motor-cars and the like)." G. J. Scott. February 5th.

2,978. "Methods of compensation for selenium cells, and in the applications of selenium cells to telegraphy." H. W. Malcolm. February 5th.

2,992. "Process for the manufacture of filaments, strips, films, sheets, and the like from cellulose solutions." Vereinigte Glanzstoff Fabriken Akt-Ges. (Convention date, April 13th, 1912, Germany.) February 5th. (Complete.)

3,006. "Contact make-and-break devices for use with electric flashing signs and the like." C. de Frettes. (Convention date, February 23rd, 1912, France.) February 5th. (Complete.)

3,012. "Wireless telephony." W. T. Ditcham and Grindell Matthews Wireless Telephone Syndicate, Ltd. February 5th.

3,046. "Magnetic seperators." Bowes, Scott & Western, Ltd. February 5th.

3,055. "Electro-automatic stop motion apparatus for knitting, weaving, and like machines." A. Runge. February 5th.

3,057. "Means for effecting ignition in internal combustion engines." G. E. Heyl and T. T. Baker. February 5th.

3,103. "Wireless telegraph, telephone or submarine signalling system." Radio-Signal Co., Ltd., W. H. Shephard and A. E. McKechnie. February 6th.

3,110. "Electric measuring instruments." E. I. Everett and K. Edgcumbe. February 6th.

3,111. "Fuses for use in electric circuits." Spagnoletti, Ltd., and V. E. Joyce. February 6th.

3,112. "Process for manufacturing ductile tungsten wires or filaments." Firm of J. Krenenezky. (Convention date, March 18th, 1912, Austria.) February 6th. (Complete.)

3,133. "Circuit arrangements for telephone exchanges." Siemens & Halske Akt-Ges. (Convention date, February 6th, 1912, Germany.) February 6th. Complete.)

3,148. "Electric heating and drying apparatus." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 6th.

3,162. "Method of making sheets, rods, wires, filaments and the like of tungsten and molybdenum or alloys thereof." Westinghouse Metallfaden Glühlampenfabrik G.m.b.H. (Convention date, February 9th, 1912, Austria.) February 6th. (Complete.)

3,224. "Ventilation of dynamo-electric machinery." Siemens Bros. Dynamo Works, Ltd., E. O. Kieffer and W. Parker. February 7th.

3,227. "Polyphase alternating-current motors and generators." Crompton and Co., Ltd., and H. Burge. February 7th.

3,238. "Electric switches." Spagnoletti, Ltd., and V. E. Joyce. February 7th.

3,246. "Wireless telegraphy and telephony." Signal Ges.m.b.H. (Convention date, February 12th, 1912, Germany.) February 7th. (Complete.)

3,249. "Electric control of alternating-current motors." Otis Elevator Co., Ltd. (Otis Elevator Co., Incorporated, United States.) February 7th.

3,250. "Electric motors particularly adapted for hoisting purposes." Otis Elevator Co., Ltd. (Otis Elevator Co., Incorporated, United States.) February 7th.

3,271. "Manufacture of a material suitable for electrical insulation and other purposes." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) February 7th.

3,309. "Insulator for supporting the current rails of electric railways and tramways." A. Watkins. February 8th.

3,326. "Electrical printing telegraphs." B. Soldatencow. (Addition to 14,659/1910.) February 8th. (Complete.)

3,339. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd. (Automatic Electric Co., United States.) February 8th. (Complete.)

3,344. "Circuit arrangements for junction lines at automatic and semi-automatic telephone exchanges." Siemens & Halske Akt.-Ges. (Convention date, February 10th, 1912, Germany.) February 8th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

Electric Heater for Fluids. J. Mann. 26,485. November 27th. (June 27th, 1912.)

Shade Supports for Electric Lamps. J. N. Mollett. 28,462. December 18th.

Brush Gear for Dynamo-Electric Machines. H. Leitner. 28,817. December 21st. (June 19th, 1910.)

Electric Switches. P. Druseidt. 28,942. December 22nd.

1912.

Transmitting Switch Apparatus for the Control of Electric Motors. Vickers, Ltd., and H. J. Creffield. 1,280. January 16th.

Electric Supply Systems having Variable-speed Generators. British Thomson-Houston Co. and E. Garton. 1,681. January 20th.

Control of Alternating-current Electric Motors. E. Rosenberg. 1,979. January 24th.

Methods of, and Machines for, Electric Welding. British Thomson-Houston Co. (Allgemeine Elektricitäts Ges.) 2,843. January 29th.

Rotating Interrupters for Magneto-ignition Apparatus. H. Diehl. 2,472. January 30th. (February 3rd, 1911.)

Renewable Electric Incandescent Lamps. E. M. Bailey and W. Plews. 3,906. February 16th.

Mine Exploders. Sterling Telephone and Electric Co. (Schaffler & Co. 5,217. March 1st. (Addition to No. 12,145 of 1911.)

Electric Block-signalling Systems. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 5,559. March 5th.

Electrical Switches. S. L. Price. 5,562. March 5th.

Electrically-operated Valve-controlling Devices. G. Keith and J. Keith. 6,517. March 16th.

Galvanometers. T. Clark and J. May. 9,094. April 17th. (Cognate application, No. 23,680 of 1912.)

Apparatus for Converting Telegraphic Code Figures into Telegraphic Words, and Vice Versa. M. W. Rehder and A. W. C. Voigtsberger. 9,195. April 18th.

Incandescent Electric Lamps. W. J. Lusted. 9,983. April 26th.

Wireless Telegraphy Apparatus. W. S. Peake. 10,501. May 3rd.

Machines for Forming Filaments for Electric Lamps. British Thomson-Houston Co. (General Electric Co.) 11,252. May 11th.

Signal Installations for Supervising the Relative Positions of Turntables or other Rotating Stations. Siemens Bros. & Co. (Siemens & Halske Akt.-Ges.) 14,658. June 22nd.

Electro-deposition of Metals and Like Electrolytic Processes, and Apparatus or Appliances to be Used in Connection therewith. A. Round and R. Fisher. 15,492. July 3rd.

Electric Boilers. J. Bally. 16,042. July 9th. (July 11th, 1911.)

Shade Holders for Incandescent Lamps. H. H. Palmer. 18,177. August 7th (March 19th, 1912.)

Electric Furnaces. J. M. Bocuze. 21,290. September 18th. (October 14th 1911.)

Electric Switches. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 21,918. September 26th.

Automatic Controlling Device for Electric Cut-outs. J. H. De Thierry. 22,251. September 30th. (September 30th, 1911.)

Electro-osmotic Extraction of Water from Animal, Vegetable or Mineral Substances. Ges. fur Electric Osmose m.b.H. 23,545. October 15th. (July 17th, 1912.)

Electrodes for Use in Producing Endothermic Reactions. H. Pauling. 24,051. October 21st. (October 24th, 1911.)

Electric Switch or/and Fuse Boards. E. J. Selby and W. Preston. 1,646. January 20th.

Electrolytic Apparatus. J. T. Niblett. 1,671. January 20th.

Electric Switches. British Thomson-Houston Co., Ltd., and E. Garton. 1,680. January 20th.

Electric Tablet Systems for Working Single Lines of Railway. A. T. Blackall and C. M. Jacobs. 1,852. January 23rd.

Apparatus for the Control of Electric Circuits. H. Leitner. 1,965. January 24th.

Dynamo-Electric Machinery. H. C. Siddeley. 1,999. January 25th.

Electric Incandescent Lamps. Deutsche Gasglulhlicht Akt.-Ges. (Auer Ges. 2,284. January 29th. (November 4th, 1911.)

Electric Lighting System for Motor-cars and the Like. British Thomson Houston Co. and E. Garton. 2,874. February 3rd.

Driving of Vehicles by Means of Internal-combustion Engines combined for Recuperating Purposes with Dynamos, Accumulator Batteries and Motors. H. Pieper. 3,2?1. February 9th. (February 20th, 1?11.)

Electric Fused Switches and Switchboards. H. H. Berry and W. J. Markham. 3,536. February 9th.